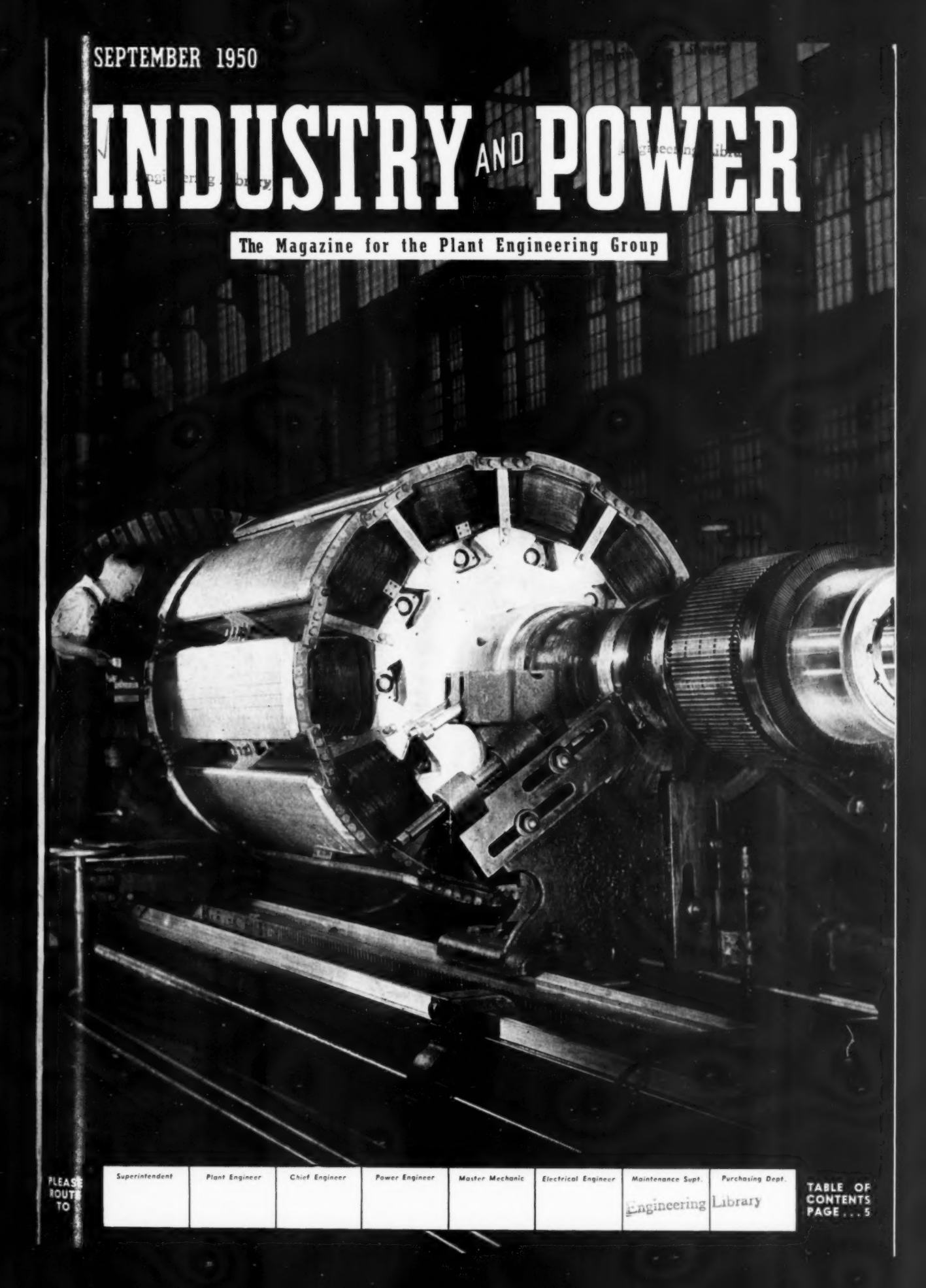
SEPTEMBER 1950

INDUSTRY AND POWER

The Magazine for the Plant Engineering Group



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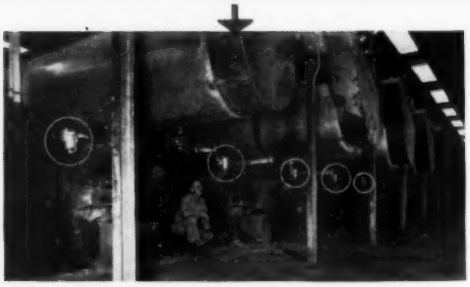
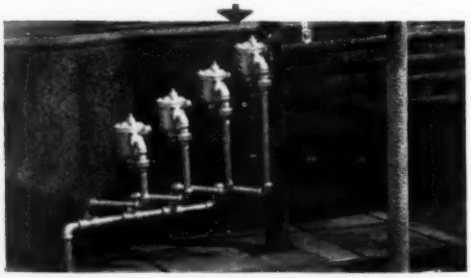
"This Trap can't leak steam . . ."

YOU SAVE MONEY



$300 PER MONTH fuel saving with 17 Armstrong traps on jacketed kettles and expeller tempering troughs. The traps cost $316. More than 1000% return per year! — *Pacific Nut Oil Co., Los Angeles.*



20% FUEL SAVING since installing 57 Armstrong traps on heating coils makes the coal pile last longer at *North Greenhouse, St. Paul.* Heating-up time has been cut in half, too.

THERE is never any loss of steam through an Armstrong Trap in proper working order, even when there is no condensate load . . . because steam never reaches the discharge orifice. The valve is water-sealed at all times. Entering steam is trapped in the inverted bucket, which then floats and closes the valve.

RESULT: You save steam, fuel and money, minimize back pressure in your return lines.

Your nearby Armstrong representative will be glad to quote on the traps you need now.

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820 MAPLE ST., THREE RIVERS, MICH.

SEND FOR the Armstrong Steam Trap Book. It describes operation of the Armstrong Steam Trap, contains prices, data, capacity chart, trap selection data for all classes of equipment.

ARMSTRONG STEAM TRAPS

Edited specifically for the plant engineering group—the executives and engineers responsible for the generation, transmission, distribution and utilization of energy in its various forms for power, processing and engineered services

INDUSTRY AND POWER

The Magazine for the Plant Engineering Group

VOLUME 59 **SEPTEMBER, 1950** NUMBER 3

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Cover Illustration

Machining the rotor-pole end plates of a 11,500-v, 720-rpm, 40,000-kva hydrogen-cooled synchronous condenser in the Allis-Chalmers shops. The unit will operate up to 48,000 kva when cooled with hydrogen at 15 psi. Exciter also hydrogen cooled

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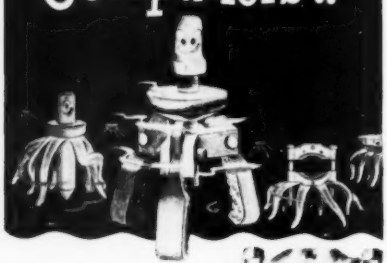
BIG NEWS!!

More PROTO* Octopullers !!



NEW Pullers!
NEW Features!!

Our Octopuller has several new brothers, to help you do more jobs—better and faster. For example, all PROTO* puller screws now have "live center" tips to prevent shaft damage. Five jaws have holes to allow bolting together, thus saving the cost of extra long jaws. These tools and the other pullers illustrated feature the famous PROTO* interchangeability of parts. To save precious hours, grab your hat, hurry to your PROTO* dealer and arm yourself with these new pullers! Write for catalog to

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Apropos of—

What You Want

KETCHUM, MacLeod & Grove, Inc., one of Pittsburgh's most progressive advertising agencies, recently recounted an interesting experience of General Motors' "Boss" Kettering which accurately reflects our own thinking on the matter of letting INDUSTRY AND POWER be exactly the magazine you want it to be.

Kettering—whose product researches resulted in the self-starter for the automobile, the Delco lighting system for the farm, tetraethyl lead and many other remarkable things—was showing a Swiss engineer a new engine General Motors was building. The engineer remarked, "How did you get yourself into the state of mind where you could design such a screwy engine as that?" Kettering told him, "We didn't design it. We simply made a single-cylinder engine and gave it some pistons to try out, and it told us which piston it liked best. Then we gave it some camshafts and it picked out the type it liked best. Nobody told the engine what it ought to be . . . we simply recognized that the engine knew more about how it should be built than any designer sitting in an office with a slide rule."

For over thirty years, we have been letting our readers try out a variety of editorial articles, and you've always told us which ones you liked best. Those are the kinds of articles we've used to build our readership interest and to make INDUSTRY AND POWER the magazine you want.

Every year, through our Readers' Service Department, we receive letters from thousands and thousands of our readers. This reader response includes requests for tear sheet copies of a variety of articles; comments that show reader reaction to our regular features; and suggestions that pertain to current problems, the solutions to which become the subjects of future articles in I&P.

These letters are supplemented by regular questionnaire mailings to generous samplings of our readers as a part of our self-initiated program to learn more accurately what kind of information you want to find in I&P. Plant calls are an ever-increasing part of the job our editors do in uncovering, simultaneously, solutions to your present difficulties and answers to your questions which are likely to arise in the near future. Our editors also take advantage of these opportunities to make a first-hand check with Plant Engineering Group members on what they look for in I&P.

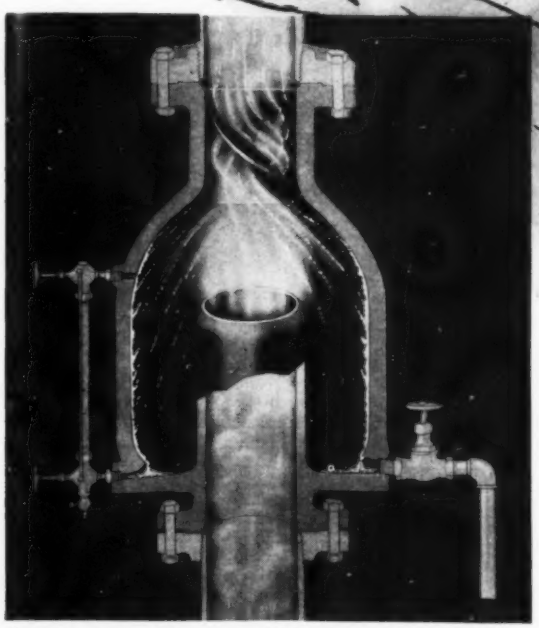
Each bit of information we obtain is carefully analyzed and tabulated periodically to give us a reliable formula for what you, our readers, expect of INDUSTRY AND POWER. And, more important, those "wants" and "needs" are incorporated into our publishing policy as quickly as possible.

Our purpose is to make the contents of I&P solely and exclusively helpful to you members of the Plant Engineering Group. We want you to continue telling us how best we can serve you.

L. G. Geist

Publisher

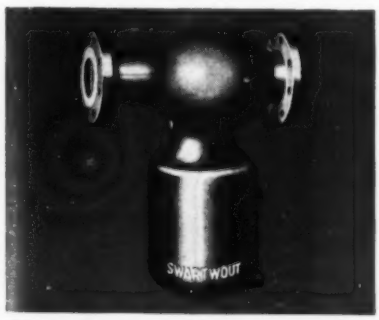
Swartwout helico-centrifugal separators assure 99% dry steam or better—with negligible pressure drop!



1 THE WHIRL DOES THE TRICK! Helix, located near separator inlet, imparts positive whirling motion . . . removes entrained liquids, solids, oil or grease from live or exhaust steam, from air or chemical vapors—*virtually without pressure loss.* Swartwout separators have no baffles, plates, grids or other parts to cause flow reversals, velocity heads or vibration. Vertical separators, above, for up flow or down flow, supplied in 50 to 600 lb. standards.

Swartwout

POWER PLANT EQUIPMENT



2 HORIZONTAL SEPARATORS, built on helico-centrifugal principle, handle any sort of separation with a maximum pressure loss of only a few inches of water under high working pressures or under vacuum. Cast iron for 50, 125, 250 lb. standards; cast steel for 150, 300, 400, 600 lb. standards.

3 EXHAUST HEADS, employing same helico-centrifugal principle as Swartwout separators, remove moisture and oil from exhaust steam . . . prevent rotting of roof and walls in warm weather and ice formation in winter. For exhaust pipes from 1 to 30 inches in diameter. See Bulletin S-16-C.

4 SWARTWOUT AIRFUGE air separator removes impurities by centrifugal force. Simple, float-operated trap releases accumulated liquids automatically while maintaining level sufficient to effect seal. Requires no maintenance except occasional blowdown. Write for special Airfuge Bulletin S-13. A-2909

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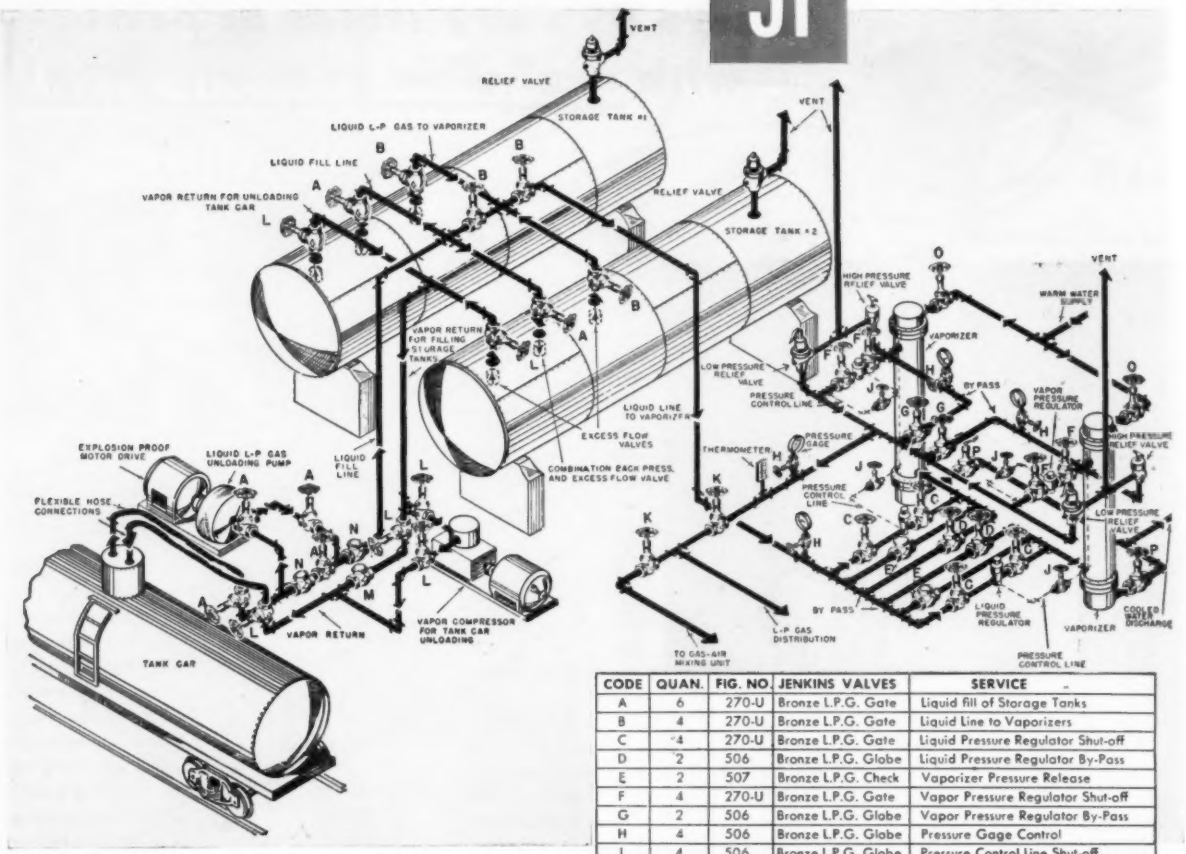
JENKINS PRACTICAL PIPING LAYOUTS 51



CODE	QUAN.	FIG. NO.	JENKINS VALVES	SERVICE
A	6	270-U	Bronze L.P.G. Gate	Liquid fill of Storage Tanks
B	4	270-U	Bronze L.P.G. Gate	Liquid Line to Vaporizers
C	4	270-U	Bronze L.P.G. Gate	Liquid Pressure Regulator Shut-off
D	2	506	Bronze L.P.G. Globe	Liquid Pressure Regulator By-Pass
E	2	507	Bronze L.P.G. Check	Vaporizer Pressure Release
F	4	270-U	Bronze L.P.G. Gate	Vapor Pressure Regulator Shut-off
G	2	506	Bronze L.P.G. Globe	Vapor Pressure Regulator By-Pass
H	4	506	Bronze L.P.G. Globe	Pressure Gage Control
J	4	506	Bronze L.P.G. Globe	Pressure Control Line Shut-off
K	2	270-U	Bronze L.P.G. Gate	Distribution System Shut-off
L	6	270-U	Bronze L.P.G. Gate	Vapor Return for Tank Car
M	1	507	Bronze L.P.G. Check	Prevent Vapor Backflow
N	2	507	Bronze L.P.G. Check	Prevent Liquid Backflow
O	2	47	Bronze Gate	Warm Water Supply
P	2	106-A	Bronze Globe	Cool Water Discharge

How to plan a STORAGE AND VAPORIZER HOOKUP FOR LIQUEFIED PETROLEUM GAS

PETROLEUM GAS, (propane, butane, etc.) liquefied at atmospheric temperatures by moderate pressures, is shipped by tank car to local storage plants. Diagram shows piping and equipment used in vaporizing and storing these gases.

THE LIQUEFIED GAS is unloaded into storage tanks with the use of liquid pump and vapor compressor. The compressor draws vapor from the tank and returns it to the tank car at a slightly higher pressure, forcing out the remaining liquid. This passes through a regulating valve, to the vaporizer where steam or hot water heating converts it to vapor.

THIS GASEOUS FUEL is then piped through a pressure regulator which assures a constant pressure, and on to the gas distribution system or gas-air mix unit. Duplicate vaporizers provide continuous service in case of breakdown. Safety relief valves are vented to the atmosphere. Check valve on vaporizer inlet acts as a relief valve when vaporizer pressure exceeds that of tank.

Consultation with accredited piping engineers and contractors is recommended when planning major piping installations.

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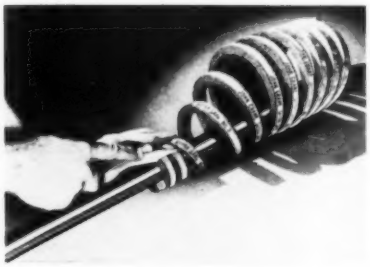
new equipment and developments

You can easily get more data on these new equipment and development items. Use the handy, postage-free order cards on Page 37. Just list the key numbers of the descriptive paragraphs in the spaces provided on the card and mail.

301—PLASTIC PACKING MORE FLEXIBLE

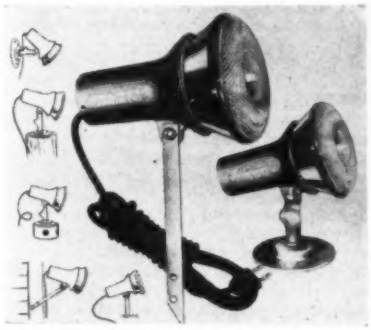
Securely-vulcanized tape backing that gives greater flexibility, extra economies, and easier identification is now a feature of all Crane Packing Co.'s "Super Seal" plastic packings. With increased flexibility, the packing allows spirals to be twisted down to small shaft sizes and cut into rings without



breakage. Identification is simpler with the tape-back, since each of six styles is clearly marked in a different color. They do not harden at elevated temperatures and need not be removed as wear occurs. Addition of another ring to the stuffing box is sufficient to maintain leak-proof service.

302—PORTABLE SPOTLIGHT

Handy portable lighting unit, developed by Stone Mfg. Co., is weatherproof, UL-approved and completely self-contained. Suitable for all applications of floodlighting, spotlighting, sign lighting, and protective building and yard lighting. Made of non-corrosive, non-rusting cast aluminum throughout, with three accessories which permit interchangeable mounting positions. The unit has a built-in tubular gasket that



seals in the bulb, and a glazed porcelain heatproof socket for use with any medium base reflector bulb or infrared heat bulb. Comes complete with 10 ft of UL-approved, SJT weatherproof cord and rubber plug.

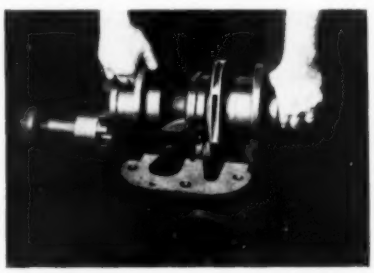
303—CONDUITS ARE HOT DIP GALVANIZED

All Gedney Electric Co. threaded conduit bodies, covers, straps and clamp backs are now produced with a heavy hot dip galva-

nized finish. This provides more zinc in a much thicker coat than ordinary electroplating, thereby insuring protection against deterioration where humidity, exposure to weather, condensation or corrosion exist.

304—NEW APPROACH TO PUMP MAINTENANCE

DeLaval Steam Turbine Co. announces a pump designed to practically eliminate field maintenance. All parts except the bare pump casing are contained in the rotor assembly and, when maintenance is necessary, simply remove top cover and end plate studs, lift out the assembly and drop a new one in place.



The GS pump also is equipped with mechanical seals and the bearings are permanently lubricated. Comes in three sizes for capacities to 450 gpm, heads to 230 ft.

305—GAS VALVE HAS SAFETY SHUT-OFF

Lock-Tite shut-off valve is offered by Eclipse Fuel Engineering Co. for complete and positive safety on all gas-fired installations by instantaneous gas shut-off under any and all unsafe conditions. It can be supplied with electric solenoid for unsafe flame conditions or with diaphragm actuators to protect against failure of either low, medium or high pressure gas and air. After flame failure the valve can only be opened or reset by hand, and only after the unsafe condition has been corrected. Various protective combinations are adaptable to individual requirements and can be removed, replaced and interchanged without taking valve out of the line. Valves are supplied in pipe sizes up to 4 in. with gas capacities up to 7,250 cfh.

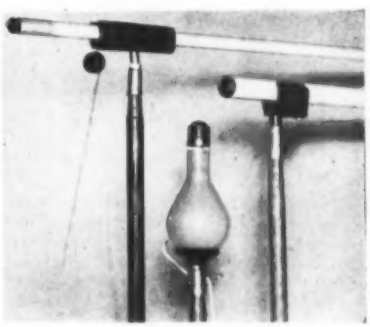
306—WIDER RANGE FOR HAND TACHOMETER

Type 25D hand tachometer is now available from Metron Instrument Co. with speed measuring ranges of 100-1000, 200-2000 and 500-5000 rpm and fpm and 10-100, 20-200, 50-500 fpm. These ranges are suited (without range extending adapters) for motor and generator testing, process con-

trol, and maintenance work. Adapters are available down to 20 rpm and as high as 50,000 rpm. Other features are: quick response—can be used for acceleration tests, self calibrating check circuit, undamaged by overspeeding, and low operating torque.

307—CHANGE LAMPS WITHOUT CLIMBING

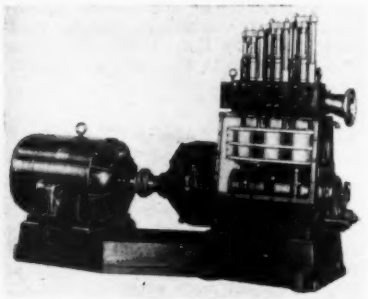
Slimline and fluorescent lamps and starters can be safely and quickly replaced in open type fixtures as high as 22 ft with changers made by Stueland Mfg. Co. Incandescent lamps from 10 w up, including PAR-38 and R-40 can be replaced with a third changer. Lamps are not released unless



the operator intends to do so. The slimline unit is a sponge rubber lined clamp which can be opened or closed by rotating the handle. T-12 and T-17 fluorescent changer design uses a spring clamp inside of which is a rubber roller. On the other end of the handle is the starter changer. The incandescent unit is of the suction cup type.

308—DIRECT FLOW APPLIED TO PUMPS

Introduction of the direct flow principle in pump design by The Aldrich Pump Co. has resulted in reduced volume of space between valves with higher volumetric efficiency up to 96%. It also employs a section-



alized fluid end which includes working barrel, stuffing boxes, valve units, plunger, and suction and discharge manifolds.

A range of 100 to 2450 hp is adaptable to oil industry applications such as primary and secondary recovery, recycling, salt water disposal, crude oil gathering lines and product lines. These pumps are also suitable for handling butane, propane, lithium chloride, diethylene glycol, and other fluids.

309—SPARGER NOZZLES CUT TANK HEATING COSTS

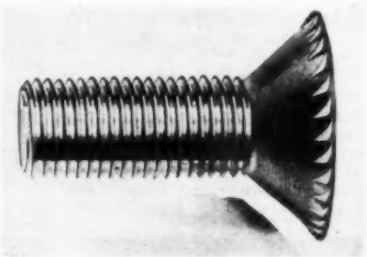
Recent installations have shown that definite savings can be realized with sparger nozzles, manufactured by Schutte and Koerting Co., instead of drilled holes in sparger pipes used in tank heating of liquids. Before, when holes drilled in sparger pipes wore excessively, it was neecessary to replace the entire pipe. With sparger nozzles, it is easy to thread a new nczzle to the pipe.

With sparger nozzles, steam, issuing from the pipe through tip of nozzle at high velocity, entrains tank liquid through the open

area on each side of nozzle. Steam and tank liquid then enter nozzle chamber where they are mixed and discharged with sufficient force to cause constant agitation with faster heating, even tank temperature and quiet operation.

311—SELF-LOCKING SCREW

A washer-less screw, the Spin-Lock, is introduced by Russell, Burdsall & Ward Bolt and Nut Co., in hex, pan, truss or flat heads. The ratchet-like teeth on the underside of the

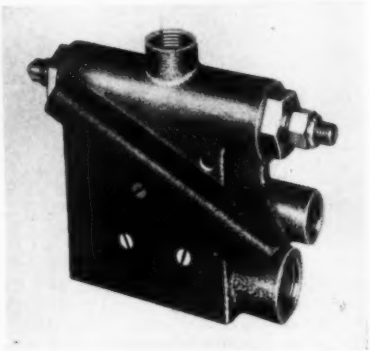


head eliminate the time-wasting step of adding a washer and screw can be hopper-fed. There is just one piece to buy and stock, locking power is positive, and fastening is neater.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

312—PRESSURE SWITCH HAS OVERLOAD PROTECTION

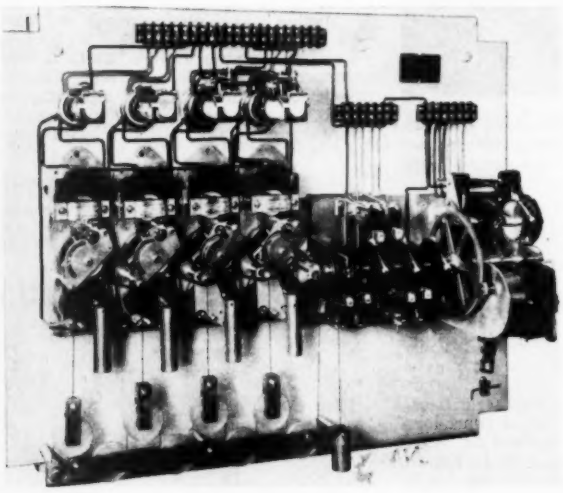
Cartridge-type, hydraulic-pressure electric switch is announced by Pantex Mfg. Corp. Designed for precise control, it will cut-in and cut-out electric circuits with as little as 12 to 18% pressure differential. Unaffected by extreme pressure surges, temporary or sustained, the unit has also withstood a wide temperature differential ranging from minus 65 F to plus 160 F without loss of



accuracy or other desirable operational characteristics. The switch is quickly and easily adjusted without breaking the line, with the added feature of pre-set switch limitations if desired.

(Continued on page 12)

310—MECHANICAL BRAIN SUPERVISES OPERATION OF SEVERAL WATER PUMPS



Builders-Providence, Inc. has announced the availability of a new device for automatically controlling pump operation. Known as the "Pressureflo" Control, this new device is developed from the original invention of Marsden C. Smith, Chief Engineer, Dept. of Public Utilities, Richmond, Va.

The control consists of a flow-determining means, a pressure or level sensing device and a mechanism to translate this "information" into a control function. Metering devices are normally desirable on any system. Other equipment consists of standard components plus a special device to convert flow and pressure into pump response.

The control may be used to start and stop pumps, to increase or decrease the speed of one or more pumps, to maintain a predetermined pressure at any point or district on a distribution system, or to automatically adjust both pressure and flow to suit varying demands. These are but a few of the many possible applications in the pumping of water, sewage, oil or gas or other liquids.

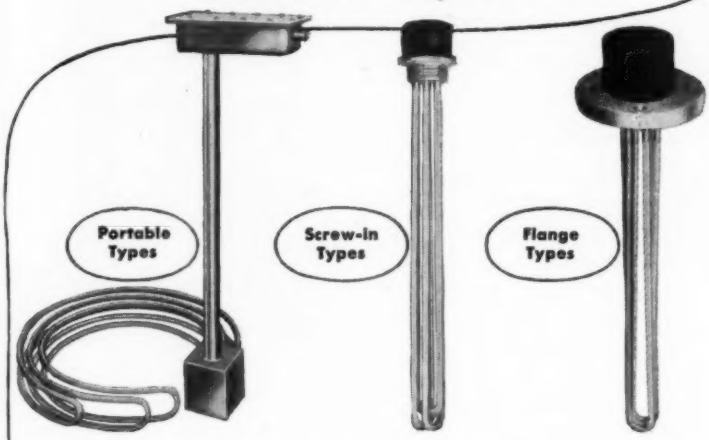
Savings resulting from the use of the control include: (1) reduced power costs by more efficient operation of pumps, (2) reduced maintenance on pumps, (3) elimination of need for station attendants (4) reduced costs of installation and operation of elevated storage tanks, (5) indirectly increasing distribution system capacity and (6) full capacity instantly for fire demands.

The pressure-flow system of control may be adapted to any distribution system, old or new, simple or complicated. No special design of pumping station is required and external control circuits are eliminated.

CHROMALOX

Electric Immersion Heaters

for Heating Water, Oils
Waxes, Heat-Transfer Mediums
and other Liquids

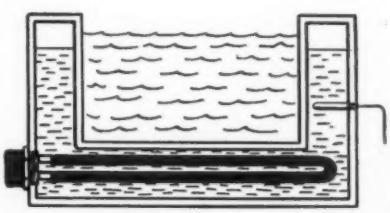


Look to CHROMALOX for Dependable Electric Heat

CHROMALOX Electric Immersion Heaters come in a full range of types for permanent or portable use. They are quickly and easily installed with minimum labor and material costs . . . and they may be manually or thermostatically controlled for accurate, care-free, dependable operation. Available in types and sizes to fit your needs in iron, steel or alloy sheaths to resist corrosion.

If you are interested in heating liquids efficiently, or if you have any other heating problem—you are invited to consult CHROMALOX.

A Typical application



Indirect immersion heating with Chromalox Electric Tubular Heaters.

OTHER UNITS AVAILABLE FOR HEATING:

Water, asphalt, greases, molten salts, pickling baths, Dowtherm, Aroclor, Prestone—for superheating steam and compressed air—for melting lead, solder, babbit and stereotype metal.

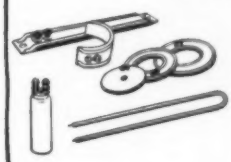
CHROMALOX

offers you the most in Electric Heat

Experience

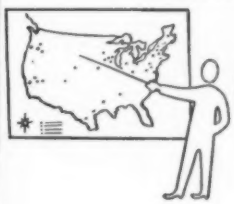
33 years experience in electric heating, covering almost every industrial process employing heat up to 1000F°

Selection



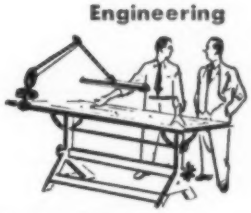
Over 15,000 types, sizes and ratings to fit most every application requiring heat.

Service



135 field engineers in 37 cities throughout the country, to give you on-the-job counsel and assistance.

Engineering



Application engineers working with research, development and manufacturing personnel provide technical know-how for solving industrial heating problems.

FOR COMPLETE INFORMATION Write for Catalog 50 which describes the complete Chromalox facilities and products designed to meet your heating requirements.

CHROMALOX

Electric Heat for Modern Industry

EDWIN L. WIEGAND COMPANY IC-49
7520 Thomas Blvd.
Pittsburgh 8, Pa.

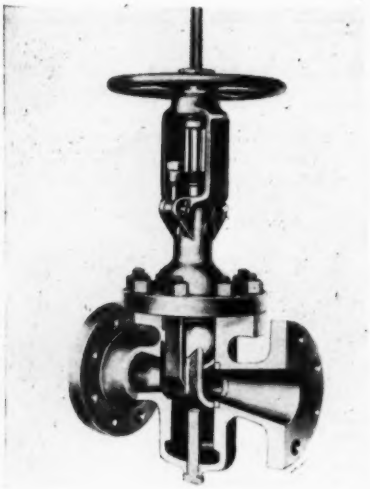
Please send me a copy of the new 48 page Chromalox Catalog.

Name.....
Company.....
Street.....
City.....Zone.....
State.....

(Continued from page 10)

313—VALVE DESIGN REDUCES TURBULENCE

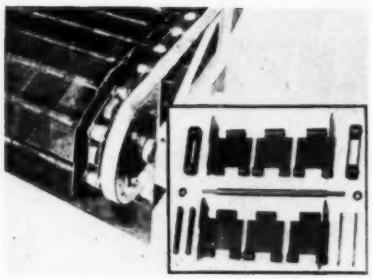
Venturi-ball valve, announced by W-K-M Co. is especially designed for throttling applications in high pressure, corrosive or erosive applications and features straight line discharge characteristics. In throttling



position, the ball presents a smooth surface, and non-turbulent flow is possible over a wide range without destructive erosion or wire drawing. Wide open flow is unobstructed, non-turbulent with negligible pressure drop. Liquids or gases passing through the venturi passage suck out dirt, scale, sediment. The ball rolls upon opening or closing, making valve easy to operate even under adverse conditions.

314—CONVEYERS CARRY HOT LOADS

Hinged-steel conveyer belting developed for mechanized handling of hot or highly abrasive metal parts was announced by May-



Fran Engineering, Inc. Ease of assembly into almost any length or width from stocked component parts is featured. Precision-formed links are made from heavy-gage steel plate, and are fastened by high-carbon steel rods so that the side chains become part of the belting. Special link and rod design, in conjunction with the side wings, eliminates fall-through of materials handled.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

316—PLASTIC PIPE IS STRONG, FLEXIBLE

Availability of Carlon pipe featuring higher burst pressure and increased resistance to suction collapse was announced by Carter Products Corp. This heavy duty pipe, type EX, is marked with a red stripe for identification, and features flexibility, light weight,

absolute resistance to rot, rust, and electrolytic corrosion. Furnished in standard pipe sizes, 2 to 6 in. dia, it can be coupled quickly and easily with plastic fittings for plastic-to-plastic or plastic-to-metal connections.

317—CONTROL CENTERS ARE COMPACT

"Plug-in" units are incorporated in a complete control center design announced by Square D Co. Up to six Size 1 or 2 starters can be mounted in a standard vertical section 20x20x90 in. high. Plug-in units

have positive pressure stabs, corner guide rails and locks.

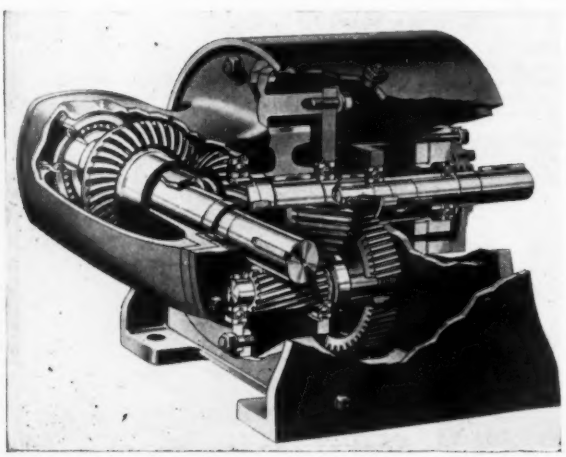
Circuit breakers are type ML thermal magnetic with trip-free, non-tamperable, factory calibrated protection. Starters incorporate new NEMA standard mounting dimensions and wiring schemes.

318—ASTM CERTIFIED THERMOMETER TEST SET

New approach to general temperature testing in laboratories — complete sets of matched, high-precision thermometers—has has been introduced by Tagliabue Instruments Div. of Weston Electrical Instrument Corp.

(Continued on page 14)

315—SPEED REDUCERS DESIGNED FOR VARIETY OF APPLICATIONS



Concentric shaft, type C, and horizontal or vertical right angle, type CB speed reducers are announced by The Falk Corp. and feature the improved all-steel housing developed to provide more rigidity, greater strength and improved appearance.

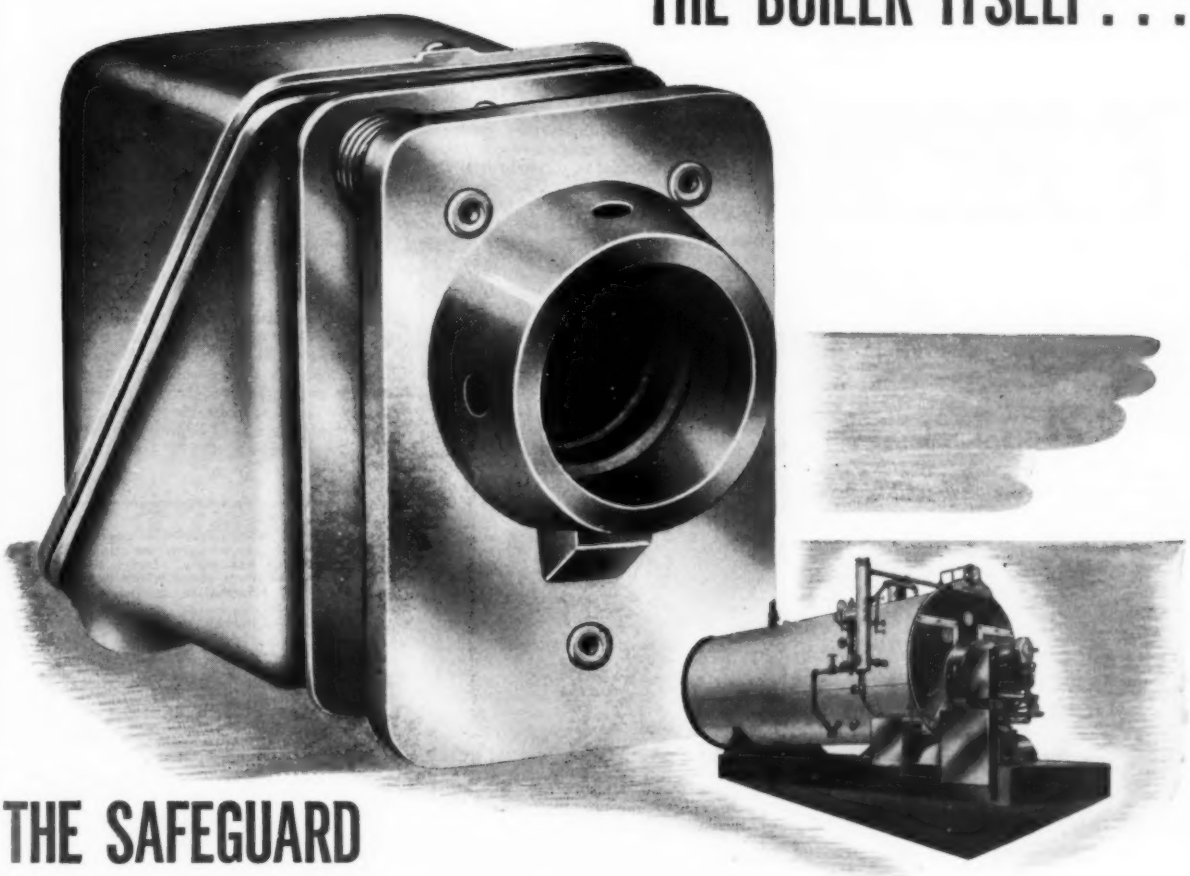
These speed reducers, designed for a wide variety of power transmission requirements in almost every industry, are adaptable to electric motor drives, belt drives, gas engine drives, chain drives, etc. They are suitable for use as a speed increaser or reducer and are rated according to standards of the AGMA.

Specifications for the concentric shaft speed reducer include a range of output speeds from 1 rpm to 1170 rpm with input speeds up to 1750 rpm and higher if necessary. High mechanical efficiency of 96% to 98½% at full load, constant during entire life of gears, is claimed. The ratio range is 1.5:1 minimum to 970:1 maximum in reducer sizes from 1 to 50 hp.

Horizontal or vertical right angle speed reducers are available with the output shaft in either horizontal or vertical positions. Output speeds are from 1 rpm to 350 rpm with input speeds up to 1750 rpm. Mechanical efficiency of 96% to 98½% at full load, depending upon number of gear trains. Minimum ratio is 5.7:1 and maximum is 515:1, and the approximate hp range is also 1 to 50.

Engineering bulletins are available and provide information on service factors, dimensions, rating tables and method of selection.

MORE IMPORTANT THAN THE BOILER ITSELF . . .



THE SAFEGUARD THAT PROTECTS IT

FACTORY MUTUAL FM APPROVED UL

Where the safety of personnel and property are vital, and where uninterrupted plant operation must be assured; Fireye Flame Failure Safeguards are certain to be specified.

Fireye insures complete flame failure protection because it is photo-electric . . . it sees the flame . . . and if flame fails, Fireye acts with the speed of light to cut off the supply of fuel *before* dangerous gases accumulate in the combustion chamber.

Controls which do not react instantly can not provide full protection . . . for it is the few seconds of delay between flame failure and fuel shutoff which charge the combustion chamber with potential destruction.

Fireye more than meets the exacting requirements of all insurance laboratories for the protection of *all* classes of oil and gas burners . . . that is why Fireye is standard with leading burner manufacturers.

To insure complete protection for your plant and personnel, write for Bulletin 604-C.

fireye

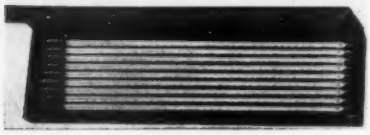
COMBUSTION CONTROL CORP.

77 BROADWAY, CAMBRIDGE 42, MASS

(Continued from page 12)

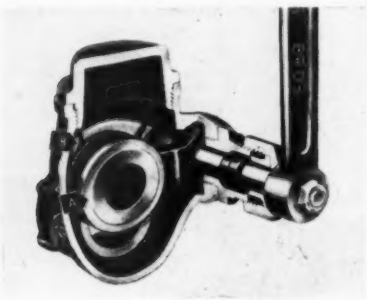
Known as the TAG-ASTM certified thermometer testing set, the unit comprises nine matched thermometers with overlapping ranges.

The instruments meet all specifications of official testing agencies covering accuracy, dimensions and performance for thermometers of this type. Inclusive ranges are: minus 36 to plus 760 F; minus 38 to plus 405 C. Calibrations are in 1/10, 1/5, and 1/2 deg C; 1/5, 1/2 and 1 deg F, with each thermometer accurate to within one scale division. Compensations for individual scale characteristics are listed.



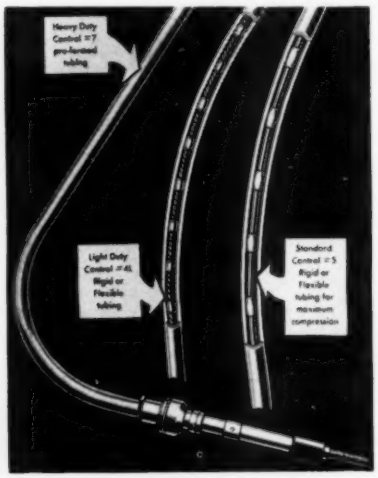
319—FAST-ACTION VALVE IS SELF CLEANING

Jenkins Bros. have introduced a rapid-action, bronze lever gate valve with ball-and-socket double discs which adjust readily to seat surfaces. Guide rims (A) rotate freely on tracks (B), cast in the body, as the valve opens or closes. This provides a self-cleaning and polishing effect, and distributes the wear. The Swingtite is rated for 125 lb steam service, 300 lb cold oil, water, and gas, and is made in ½ to 2 in. sizes.



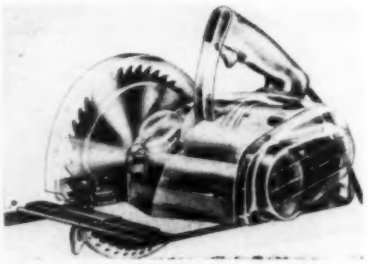
321—PUSH-PULL CONTROLS ARE ACCURATE, STRONG

Pre-assembled and pre-formed push-pull controls for efficient transmission of motion are being manufactured by the Industrial Div. of Simmonds Aero-cessories, Inc. Basic elements are a moving member or linkage, enclosed in either a rigid or flexible casing, or a combination of both. Two types of linkage are available: No. 4, ¼-in. OD light duty control; and No. 5, 5/16-in. OD and No. 7, 7/16-in. OD for accuracy and strength. Various standard end fittings are available.


Heavy Duty Control #7 pre-formed tubing
Light Duty Control #4L Rigid or Flexible tubing
Standard Control #5 Rigid or Flexible tubing for maximum compression

322—BELTS DRIVE PORTABLE SAW

Syntron Co. has just put on the market a belt-drive portable electric saw weighing 19 lb with a 1½-hp universal motor drive and an 8½-in. blade. The use of V-belts entirely eliminates gears, gear box, gear grease leakage and high gear maintenance expense and cushions the motor from any sudden shock or overload. Metal stampings insure ability to stand up under hard usage. Adjustable base makes bevel cuts from 90 to 45 deg and cuts from 0 to 2 11/16 in. deep.



For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

323—POWER THREADER IS LIGHTWEIGHT

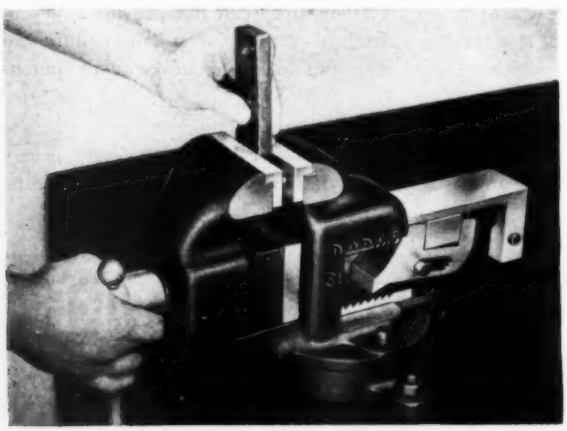
Beaver Pipe Tools, Inc. announces its model E pipe and bolt machine, a 185-lb power tool for cutting and threading pipe, bolts and conduit up to 8 in. An outboard

(Continued on page 16)

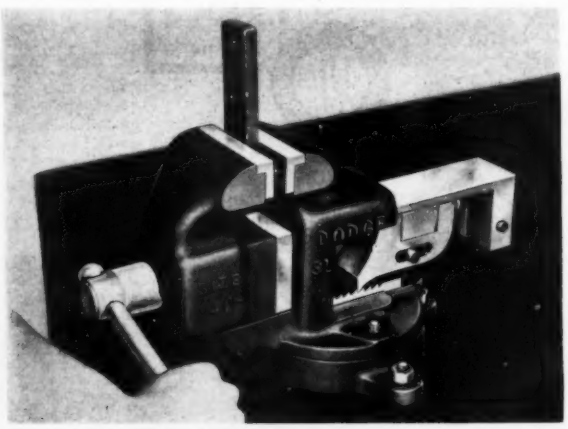
320—NO SCREW SPINNING WITH THIS VISE

A 4-in. quick-action, machinists' vise, announced by Dodge Mfg. Corp. does away with endless spinning of the screw to go from one sized jaw opening to another. The vise opens or closes to any position in one second through a push-pull action. Cutaway views show how dog locks into rack when screw is turned.

Slide action is simple, fast and positive. A turn and a half of the handle counter-clockwise—and the jaw slides in "neutral" to any position. From the moment the work is engaged the vise operates in the conventional manner. A specially designed no-pinch handle protects the operator against blood blisters between the thumb and forefinger. Vise is provided with either a swivel or stationary base for bench mounting.



A PUSH CLOSES JAWS ON WORK



CLOCKWISE TURN LOCKS OBJECT

You get MORE CAPACITY with a FANMIX BURNER

Increase Boiler Ratings On Present Or Planned Equipment

In all types of Coppus-Dennis FANMIX Burners — straight gas or combination gas-oil — we utilize the energy of the fuel under pressure to drive the burner fan and deliver air in the proper proportion to the fuel flow. This exclusive "pinwheel action" *mechanically* mixes fuel and air in exactly the right proportions for truly radiant, non-luminous heat.

The result is uniform temperature everywhere in the combustion chamber — no drifting "hot spots" — and complete combustion under all conditions. That's why you can release more heat into your present furnace — why in new installations you get more heat into smaller furnace space.

FANMIX Saves On Both Old and New Installations

FANMIX can easily be operated with your present furnace and stack, requiring only minor changes in other equipment. Or if you're planning on new boilers, remember that FANMIX relieves the furnace from the burden of mixing, creates its own forced draft and takes smaller pipe sizes. Which means you can plan on reduced combustion space, less stack, no forced draft equipment and lower installation costs all around.

Get the Whole Story

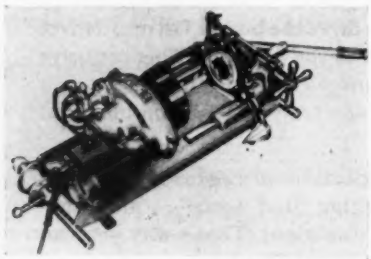
Coppus engineers FANMIX Burners to meet individual requirements, providing complete control over heat pattern and combustion . . . Learn more about how "pinwheel action" can step up *your* boiler performance to peak efficiency and economy — as it is doing throughout industry. Send for Bulletin 410-6. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, and MINING CATALOGS.

COPPUS ENGINEERING CORP.
189 Park Ave.
Worcester 2, Mass.
Please send Bulletin 410-6 to:
Name.....
Company.....
Address.....
City.....Zone.....State.....

(Continued from page 14)

eccentric-spool steady-rest prevents long lengths of overhanging revolving pipe from "rocking" the spindle.

Model E uses the same die heads, dies, cutoff devices, and reamer arm and cone as



the models A and B, and eliminates the necessity of carrying in stock duplicate dies and parts.

324—UNITS CONDITION CRANE-CAB AIR

To fill the need for equipment that ventilates, heats and provides dust and fume protection for operators of crane cabs, Dravo Corp. has developed two types of conditioners. Model VHDF is designed to provide continuous ventilation, heating, dust filtering, and fume protection for crane cabs and small confined spaces in industrial plants. Model VHD, illustrated, performs the same functions except for fume removal and is intended for use where noxious fumes are not a problem. Either unit will operate on a-c or d-c power. Model VHDF is 16 x 26 x 42 in. Model VHD is 16 x 26 x 26 in.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

326—TAPE PROTECTS PIPE AGAINST CORROSION

As announced by Minnesota Mining & Mfg. Co., Scotch electrical tape No. 22 is used as anti-corrosion protection for buried pipelines. It eliminates the dangers and difficulties associated with the use of hot coatings and saves up to 50% over other coating methods. Tough, flexible and stretchy enough to conform snugly to uneven surfaces, it presents effective resistance to moisture, alkalies, acids, oils and fungi.

327—AIR-OPERATED PUMP TRANSFERS LIQUIDS

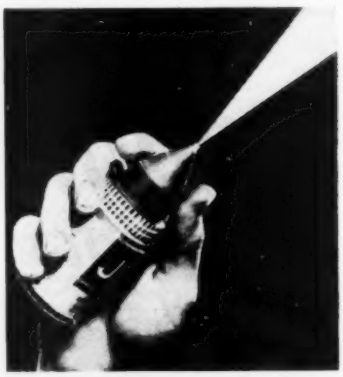
Air-operated pump—called the Fast-Flo—for quick transfer of fluids and semi-fluids has just been announced by Gray Co., Inc.

Delivery up to 18 gpm, at an operating pressure of 150 psi, is claimed for No. 20 lubricating oil, or materials of like consistency. The pump will empty a full barrel of material in less than 3 minutes, but the rate of delivery can be regulated.

It is suitable for the transfer of paint, thinners, lubricants, coolants, alcohol, naphtha, adhesives, non-corrosive chemicals, and many other materials. The new transfer pump weighs only 15 lb, and fits all drums with 2-in. openings. Included are bung hole adapter, 3-ft hose, air control valve, and snap-on airline coupler.

328—GRAPHITE GUN SPRAYS ANY DIRECTION

Finger-tip squeeze on the rubber top of the new Dry-Lube graphite gun, manufactured by Container Specialty Co., sprays up or down, without squirting or clogging. It is filled



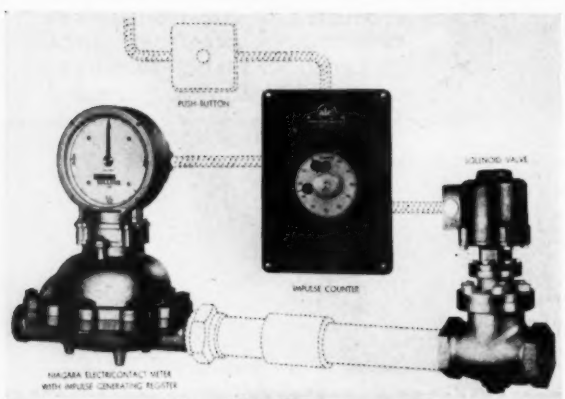
with several thousand shots of air-floated graphite. Just the thing for bearings, gears, locks and machinery. The laminated fiber container withstands abuse of machine shops, garages, locksmiths, repair shops, and service tool kits.

329—COLD REPAIRS REPLACE SOLDER

From the automotive field, the new Fixx cold "solder" method is being introduced to general industry by H. K. Porter, Inc. The solder is applied like putty but hardens and like metal, it can be ground, filed, sanded, polished and painted. Non-shrinking, non-rusting, waterproof and flexible, it

(Continued on page 122)

325—IMPULSE SYSTEM MEASURES AND CONTROLS LIQUID FEED



A system for accurate automatic liquid measurement was announced by Buffalo Meter Co. Called Electrivolume, the control system permits complete push-button control of repetitive deliveries of predetermined quantities of liquids. The measuring is performed by a Niagara Electricontact meter, built for whatever liquid is being used. Cold or hot water, viscous or non-viscous oils and many corrosive chemicals can be measured in this way.

Upon delivery of each unit of liquid, the meter generates an electric impulse. This is transmitted to an impulse counter which accumulates up to the predetermined and preset number. When this is reached, the counter actuates another electric circuit which shuts a solenoid valve, and simultaneously recycles itself back to zero ready for the next run. The impulse counter recycles to zero in one second.

The unit opens up a new field for industrial meter control of repetitive deliveries. Previously it has been necessary to reset the meter manually to a new preset position before each run, to sacrifice the ability to change the preset position, or to use a more expensive system to obtain the desired results.

An alternate use of the meter is to actuate an electrically driven integrator remotely located from the meter itself.

3 GOOD WAYS TO Stop Wasting Water

1 Make *raw* water fit for industrial use by *straining* it.

If you're in a scarce-water community, save water and cut your water bill—use a Cuno FLO-KLEAN strainer to remove trash from river or lake water. Its permanent wire-wound cartridge positively removes all solids larger than specified*, with negligible drop in pressure.

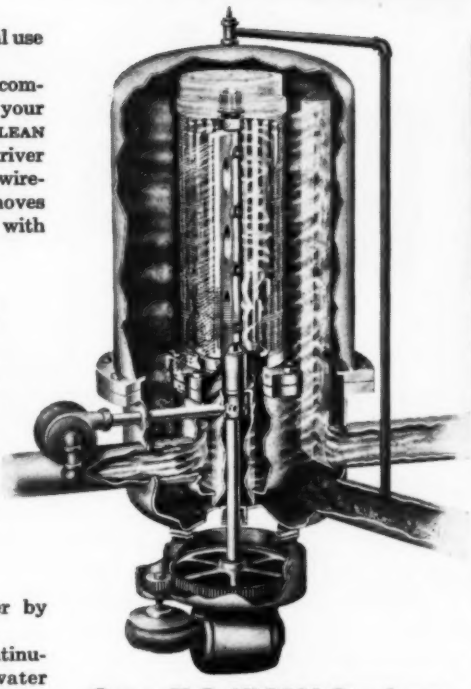
2 Reclaim and recirculate *used* water by *straining* it.

If you use water for process work, lower your water and water-heating costs—clean out contaminating solids with a Cuno FLO-KLEAN, and recirculate. Being continuously self-cleaning, it handles full flow—no expensive duplex installation needed.

3 Save valuable *backwash* water by using a FLO-KLEAN strainer.

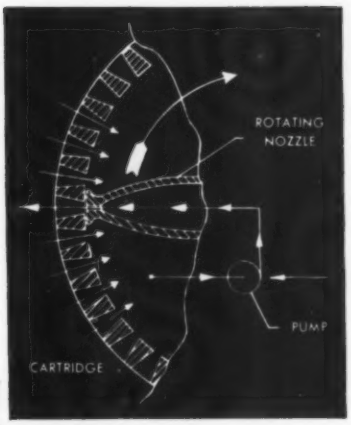
Only Cuno FLO-KLEAN is continuously self-cleaning without water waste. Used backwash is returned to the system. And—with automatic cartridge and automatic top and/or bottom blow-down—it can be installed in a remote place and virtually forgotten.

*Available spacings from .0025 to .020 in.



Cuno FLO-KLEAN Strainer

Permanent, abrasive and corrosion resistant.



Cuno's unique backwash system wastes no water.

FLO-KLEAN PAID FOR IN ONLY 6 MONTHS!

A bottling plant in a scarce-water area saved water and paid for its FLO-KLEAN in 6 months out of savings from making wash water reusable.

Find Out How to Save Money *cleaning any fluids containing abrasives*

CUNO ENGINEERING CORPORATION
1410 South Vine St., Meriden, Conn.

Please send information—without obligation—on Cuno FLO-KLEAN for application noted:

.....
.....
.....

Name.....Title.....
Company.....
Address.....
City.....State.....

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

No Fluid Is Better Than Its Filtration

CUNO

Complete Line Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

MICRONIC (MICRO-KLEAN) DISC-TYPE (AUTO-KLEAN) WIRE-WOUND (FLO-KLEAN)

There's a C-E Stoker that meets your needs exactly

There is no such thing as an "all purpose" stoker. Each type has advantages that are fully realized only when matched with coals of definite characteristics under well-defined operating conditions.

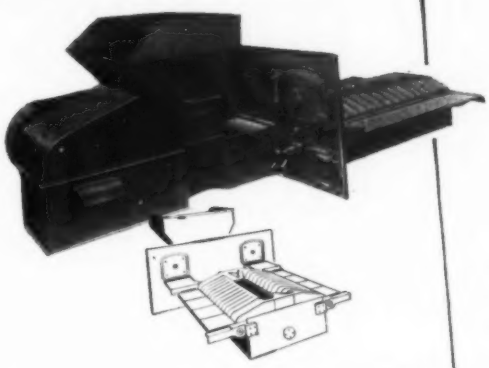
The importance of getting the *right* stoker is readily seen when you consider that the price you pay for it is only a down payment on the continuing cost incident to steam generation. Why? Because the cost of fuel burned every year throughout the useful life of the equipment far exceeds the original purchase price of the stoker. And, at today's coal prices this fact is of paramount interest to you.

Although the complete line of C-E stokers includes seven basic designs, one of the three types shown on the opposite page will prove to be most suitable in 4 out of 5 installations. Each of these stokers represents an outstanding value in its respective field. Each reflects the practical knowledge of fuel and operating conditions Combustion has gained through 65 years experience in stoker design and application . . . with more than 20,000 installations above residence size.

You can assure yourself of top stoker performance by coming to C-E — stoker headquarters — the next time you are in the market. Since C-E engineers have at their disposal every type of stoker equipment they can afford to be completely impartial in recommending the installation which fits your needs *exactly*. B-408

COMBUSTION ENGINEERING

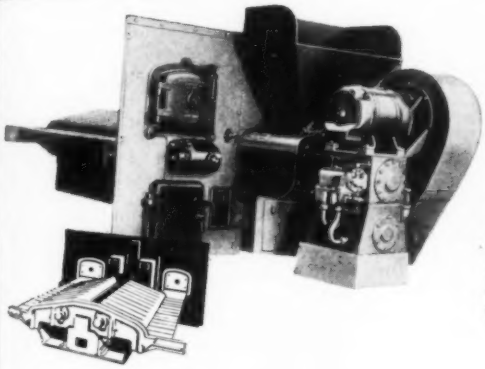
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



SKELLY STOKER UNIT

Approximate Application Range—20 to 200 boiler hp.

A compact, self-contained underfeed stoker available in designs for burning either anthracite or bituminous coal. An alternate arrangement of fixed and moving grate bars assures lateral distribution of fuel and maintains a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. An integral forced-draft fan, with inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.



TYPE E STOKER

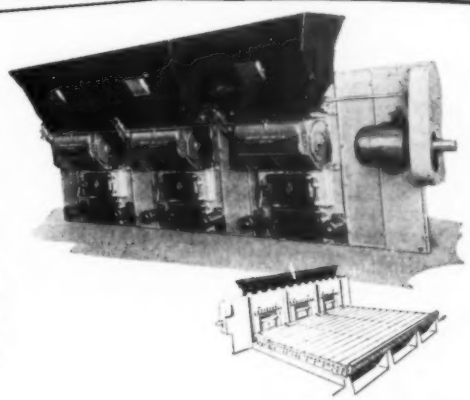
Approximate Application Range—150 to 600 boiler hp.

A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals, particularly those having caking and coking characteristics. The Type E has ram type feed supplemented by a reciprocating sliding bottom. Its grate surface consists of hollow, air-cooled grate bars arranged in an alternately fixed and moving relationship to condition the fuel bed and assure its steady movement to the dump trays which are of the cantilever type. Air supply is under zoned control with provision for introduction of air over the fire. Type E Stokers are available with steam, electric or hydraulic drive.

SPREADER STOKER

Approximate Application Range—150 boiler hp. up to units producing 200,000 lb of steam per hr, or more.

The C-E Spreader Stoker is available in both dumping grate and continuous discharge types. This simple, rugged stoker is designed to burn a wide variety of coals. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on the grate. Grate surface is zoned for regulating air admission and to facilitate cleaning. All parts subject to wear are readily accessible for inspection, adjustment or replacement, when necessary. Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.



— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.
C-E

new bulletins and catalogs

Be sure to order your free copy of these booklets—they're the latest information published by leading manufacturers. Use the postage-free order cards on Page 37. Just list the Key Letters of the bulletins you want in the spaces provided on cards.

BOILERS, AUXILIARIES, ACCESSORIES

Proportioning Oil Burners (A). This 8-page bulletin on type BI proportioning oil burners contains dimensions, capacity tables, shutter and support data plus typical layouts and installations. Various sizes give a capacity range from 3 gph to 250 gph. The Anthony Co.

Evaporators (B). Illustrated 4-page bulletin describes evaporators and particularly their conversion to low pressure vacuum type distillation plants. Includes photographs, cycle diagrams of single and double effect plants, and performance data. Also describes how existing evaporators may be rearranged and supplemented for economic benefits. Davis Engineering Corp.

Instantaneous Hot Water (C). Informative 4-page bulletin points out the features of instantaneous steam injection heaters. Also shows a simple cost-check table for comparison between various heating methods. Cited are instant availability of any volume of hot water, automatic adjustment, space saving, and a noise elimination feature. Specifications of the seven sizes are furnished for both direct and accumulator applications. Pick Mfg. Co.

Heat Enclosures (D). Pamphlet describes features of pendulum-hung insulated arches for heat enclosures. Cites a host of applications for many industries. George P. Reintjes Co.

Over-Fire Air (E). Illustrated 8-page folder gives description and technical information on a new over-fire air system. Equipment is designed to maintain maximum combustion of coal fuel, and eliminate the smoke nuisance. The Canton Stoker Co.

Coal Cracker (F). Features of a 20 to 50 ton per hr cracker are thoroughly discussed in 4-page illustrated bulletin. Also gives complete specifications and dimensions. Eagle Iron Works.

Oil Burners (G). Features of high-pressure venturi atomizing oil burners are thoroughly discussed in this 8-page illustrated bulletin. Also contained are specifications with capacity and pressure tables for the many types fabricated. Hauck Mfg. Co.

Spreader Stokers (H) Attractive two color folder shows by photographs and drawings the operating features of these automatic stokers. Describes how the stokers meet firing requirements for each particular installation up to 1000 hp. It also contains diagrams of installations. The Standard Stoker Co., Incorporated.

Refractory Mortar (I). The composition, properties and applications of this chrome bonding cement, for use with all types of refractories, is clearly explained in 4-page brochure. E. J. Lavino & Co., Refractories Div.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Turbines (J). Illustrated with photographs and drawings, this 12-page bulletin on multistage turbines gives data on casing, lagging, blades, nozzles, wheels, shafts, diaphragms, bearings, interstage and end glands, governors, synchronizers, governor valves, steam strainers, nozzle control valves, sliding feet, auxiliary oil pumps and lubrication. The Terry Steam Turbine Co.

Hydraulic Turbine (K). Profusely illustrated with photographs and detailed cross-section drawings of typical installations, this 56-page bulletin describes the design and construction of Francis, propeller and impulse hydraulic turbines. It also describes such auxiliaries as pressure regulators, special high-head valves, butterfly valves and cabinet type governors for large units. Allis-Chalmers Mfg. Co.

WATER AND LIQUID TREATMENT

Water Treatment (L). Conditioning of water for industrial use is covered in the following three bulletins: "Water Softening by Zeolite," contains 24 pages, includes principles of operation and plant design. "Aeration," 12-page bulletin, deals with the benefits of aeration in connection with oxidation, odor removal, taste removal, and separation of gases from liquids. "Filters," brochure of 12 pages, discusses the removal of suspended materials such as iron, manganese and sediment. All three include illustrations and data on selection, installation and operation of equipment. General Filter Co.

Fuel-Oil Treatment (M). Folder describes the homogenizing fuel-oil treatment that disperses sludge and water, holding it in suspension for atomization and maximum burnability in all grades of fuel oil. Shows the benefits, economy and money saving attributes of this non-toxic, non-corrosive, non-explosive liquid fuel-oil treatment. American Sand-Banum Co., Inc.

Scale Prevention (N). Folder cites typical applications of "threshold treatment" to prevent lime scale deposition in boiler feedwater lines, water heating, recirculating, cooling systems, multiple-effect evaporators, and after-precipitation following lime-soda softening. Calgon, Inc.

ELECTRICAL EQUIPMENT

Airblast Breakers (O). Outdoor airblast circuit breakers for voltages from 69 to 230 kv is the subject of informative 20-page bulletin. Contains specifications, and electrical and pneumatic data in addition to diagrams and drawings. Details are thoroughly discussed and a summary completes the booklet. Brown Boveri Corp.

Airblast Breakers (P). Outdoor airblast circuit breakers for voltages from 14.4 to 46 kv are thoroughly discussed in 20-page booklet. Drawings, diagrams, specifications, electrical and pneumatic data, are presented. Brown Boveri Corp.

Power Cable (Q). Booklet on power cable for circuits up to and including 15,000 v contains charts and tables on physical and electrical properties. Also covers splicing and terminating, specification data, and application. Explained, too, are savings to be realized by the use of super coronol-geoprene cable. General Electric Co.

Transformers (R). Complete listing of transformers, reactors and filters is contained in 28-page catalog. Includes descriptions, applications, specifications, amplifier circuits, curves and useful charts. United Transformer Co.

Electric Products (S). An overall view of "Custom-Built Equipment for Industry" is given in 10-page bulletin that illustrates and describes in detail the types of electrical equipment produced for industrial users. A-c and d-c motors and generators, frequency changers, and battery chargers are a few of the subjects covered. The Electric Products Co.

Lighting Guide (T). Concise 32-page book covers the latest concepts of planned lighting for industry, the benefits to be gained and methods to employ. Subject is broken down into:

(Continued on page 22)

WHY Clean Intake Filters More Than Once A Year?

YOU DON'T NEED TO WITH STAYNEW!!!

Efficient Operation Up To 20 Months Reported By STAYNEW Users

TEXAS OIL OPERATOR:
"Conditions severe, but Staynew filters require cleaning only once every 15 months."

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Model KE

Model C

Model D

Model DS

Model IDR

Models F and G

And When Staynews Do Require Cleaning... IT'S A CINCH!

These Staynew Intake Filters are dry type. There are no moving parts, no liquids, no reservoirs to be re-charged. They can be cleaned in just a few minutes by either vacuum or washing.

6 Models From 5 to 16,000 CFM

All Feature Original Radial Fin Design, Providing Maximum Filtering Area in Smallest Possible Space.

Model KE For small capacity use where weather housing is not required.

Model C Original *Protectomotor* design. For small capacity use where weather housing is required.

Model D The standard for heavy duty intake service on large engines and compressors.

Model DS Similar to Model D with the addition of a silencing chamber.

Model IDR Has the convenience of ground level installation plus the advantage of high level air intake.

Models F and G Low cost units for medium intake sizes.

COMPLETE DETAILS ON REQUEST

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

(Continued from page 20)

economics, program development, and equipment selection. Benjamin Electric Mfg. Co.

Lighting Fixture Hangers (U). General and detailed information, including specifications, on a line of disconnecting and lowering lighting fixture hangers, accessories, special devices, and parts are contained in 80-page booklet. Sectionalized for easy reference, it contains a wealth of photographs and drawings to illustrate the operating features, applications, modifications and component parts. The Thompson Electric Co.

Circuit Breakers (V). Fully magnetic non-thermal, non-enclosed, general purpose circuit breakers are described in 12-page bulletin. Illustrations, charts, curves, graphs and cutaway drawings portray a line of one-, two-, and three-pole breakers. Special treatment is given the subjects of true inverse time delay, high speed latch and magnetic blowout. Heinemann Electric Co.

Transformers (W). Design and construction features of power and distribution transformers — both large and small and secondary network—are described and illustrated in a 16-page bulletin. Also discusses step regulators, pole-type regulators, unit substations of all types, and instrument transformers. Allis-Chalmers Mfg. Co.

Induction Motors (X). A wide choice of induction motors and generators for instrumentation and control work is provided by 15 units including 5 new types, described in a 16-page booklet. Also contains specifications, typical performance curves and outline drawings. Arma Corporation.

Magnet Wire (Y). 32-page booklet combines the listing of both film-type and asbestos and glass-insulated magnet wire. The properties, applications, advantages and available size are fully covered. Booklet also contains considerable test data, graphs, illustrations and pertinent specification tables. Installation details are clearly described. General Electric Co.

Two-Element Fuses (Z). The use of two-element fuses for protection against electric motor burnout caused by small excess currents is explained in 4-page bulletin. Contains data on normal and instantaneous overloads as well as selection tables. Various sizes to 25 amp for use on 125 v, or less, circuits. Bussman Mfg. Co.

Variable Transformers (2A). Complete line of variable transformers is featured in 16-page bulletin. Describes in detail both manually operated and motor-driven types. Includes data on oil-cooled and explosion-proof types. Well illustrated with photographs, performance curves, graphs, and wiring diagrams. Rating chart occupies back cover. The Superior Electric Co.

INSTRUMENTS, CONTROLS, RECORDERS

Step Motors (2B). How one component can take the place of two in instrumentation and control work requiring the transmission of both data and torque, is indicated in 4-page folder titled "Step Motors." Arma Corp.

Packaging Meter (2C). Meter which automatically dispenses any preset quantity from 1 to 100 gal is described in 4-page illustrated folder. Suitable for most liquids. Iron, bronze or stainless-steel construction. Bowser, Inc.

Smoke Indicators (2D). Photoelectric system that detects, indicates and records smoke conditions is presented in attractive 8-page bulletin. Contains installation and maintenance data along with specifications and dimensions of many types. Combustion Control Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Feedwater Control (2E). Compares the one, two and three element boiler feedwater control systems. Advantages of each are featured in 8-page brochure that describes and illustrates the three systems. Republic Flow Meters Co.

Smoke Alarm (2F). Complete description plus simple installation instructions along with photographs feature this 2-page bulletin on photoelectric smoke alarm. General Power Plant Corp.

Photoelectric Amplifiers (2G). Illustrated 8-page catalog describes in some detail 33 items of photoelectric equipment and accessories for industrial applications, production control, counting, boiler and ventilating smoke detectors, burglar and warning devices. Also describes an engineering service for equipment requiring special design. De-Tec-Tronic Laboratories, Inc.

Insulation Testers (2H). With capacities from 360 va to 5 kva and test voltage ranges from 3,000 to 30,000 v a-c, 13 models of high-potential insulation breakdown testers are illustrated and described in 4-page bulletin. Many applications are shown. Associated Research, Inc.

Pressure Regulators (2J). The basic differences between flowing service and dead-end regulation are defined in 4-page engineering paper: "Performance Characteristics." Presents suggested tests, capacity charts and other data to aid in clarifying the problems of small volume air pressure regulation. Conoflow Corp.

Thermocouples (2K). Catalog section, 8 pages, describes and illustrates full line of industrial thermocouples. Contains calibration charts, specifications, cutaway drawings and other data. Thermo Electric Co., Inc.

Air Control Valves (2L). Catalog, made up of individual data sheets for each product, contains complete specifications on a full line of valves for hand, foot, mechanical or electrical control of single- and double-acting air cylinders. Describes construction, operation, valve services and gives detailed drawings, dimensional tables and other information. Airmatic Valve, Inc.

Electronic Timer (2M). Design, application and construction details together with installation and operating instructions are clearly shown in 4-page illustrated bulletin on compact electronic timer. The device provides automatic control. General Electric Co.

Flow Instruments (2N). Complete new 28-page illustrated catalog discusses basic devices for coupling a primary metering element to a secondary or exhibiting instrument, as well as magnetic clutch and electrical impedance-bridge transmitting systems. Instruments illustrated and described are flow indicators, recorders, integrators and a new pneumatic controller unit. Fischer & Porter Co.

MATERIAL HANDLING

Shale Shakers (2P). Illustrated 12-page booklet describes and tabulates new model shakers of 2, 3 and 4 ft width by 4 or 5 ft length of screening deck. Also contains operating instructions and a complete replacement-parts list. Link-Belt Co.

Big Concrete Mixers (2Q). Bulletin presents concrete mixers in 3 sizes—1-yd portable to 4½-yd stationary—for use in central mixing plants and large construction jobs. Illustrates how the mixers, when installed in a central mixing plant, can be used in conjunction with truck mixers or agitators. Attachments and accessories, such as the hydraulic control system, are shown along with complete specifications and dimensions. Worthington Pump and Machinery Corp.

Circular Bin Discharger (2R). Photographs and cross sectional drawings illustrate this 4-page bulletin that covers design, specifications, capacities and typical installations of two types of circular bin dischargers. These units are said to improve handling difficult materials such as, pulverized, granular, glutenous and soft lump substances. Stephens-Adamson Mfg. Co.

Electric Hoists (2S). New line of heavy-duty electric cable hoists with capacities to 5 ton is fully covered in an attractive, three-color illustrated, 8-page folder. Photos, diagrams, line drawings, specifications and prices are included. The Ohio Electric Mfg. Co.

Outdoor Fork Truck (2T). Gas truck for outdoor use is thoroughly described in 4-page bulletin that also contains capacity chart, dimensional drawings, specification details and illustrations of outstanding features. The Yale & Towne Mfg. Co.

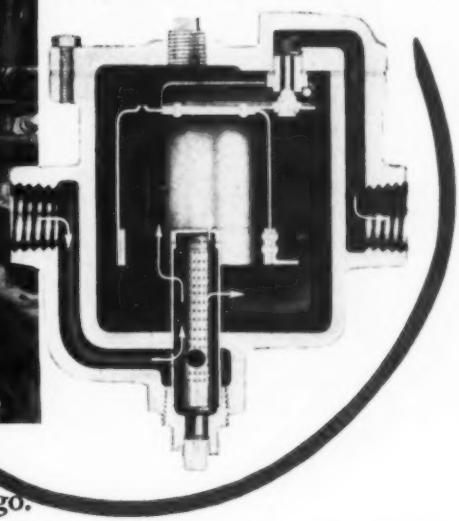
POWER TRANSMISSION

Flat Belt Drive (2U). How a flat leather belt, two flat pulleys and a tension-controlling motor base function to

(Continued on page 24)

five million TRAP DAYS *of Satisfactory Operation with*

A few of the 100 Sarco Bucket Traps in this Plastics Plant



Here's a "test" to end all tests as far as steam traps go. More than 100 Sarco Bucket Traps in operation 24 hours a day most of the time for more than 15 years! As the manager of this plastics plant puts it "They are tops in satisfaction—what more can I say." And the mechanic who put them in and has had charge of the steam service for 22 years, says "Sarco ended our trapping problems 15 years ago."

IT COSTS LESS TO BE RIGHT — The invariable result of adding Sarco Steam Traps and Temperature Controls to improve production is a *saving in fuel costs.* Heat where you want it, when you want it — never too much — or too little or too late. To be right the first time see Sarco first.

SARCO BUCKET STEAM TRAPS

SARCO Bucket Steam Trap clears condensate instantly. And it costs less to install because of the built-in strainer (at no extra cost) and the straight-thru connection which saves piping materials, time and labor. Ask for Catalog No. 350.

310

SARCO SAVES STEAM

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Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

(Continued from page 22)

transmit power smoothly and efficiently is presented in 4-page illustrated folder titled "What Is The Uni-Pull Drive." American Leather Belting Association.

Speed Reducers (2V). All the latest AGMA hp ratings are covered in 32-page bulletin on worm gear speed reducers. It describes the fabrication and lists the various types of speed reducers; also contains a section on vertical speed reducers for cooling tower service. Included are selection tables, overhung load rating tables, and dimension tables. De Laval Steam Turbine Co.

Packaged Roller Chains (2W). Complete details on a new packaging program for entire line of roller chains and parts is announced in 4-page catalog. All available standard packaged quantities are listed, together with package weights and list prices. Morse Chain Co. Div. of Borg-Warner Corp.

Gear Catalog (2X). Gear book contains much information on new stock items together with applications, selection and reference data. Lists over 100 product groups in the power transmission field—over 4,500 stock items. Provides engineering data, formulas, hp rating charts and selection charts. Boston Gear Works.

Speed Reducers (2Y). Illustrated with photographs and cross-sectional drawings, this 16-page bulletin contains data on a line of concentric shaft speed reducers. Includes sections on selection, hp rating tables, torque capacity tables, maximum overhung loads, order guide and dimensions. The Falk Corp.

Variable Speed Drives (2Z). Illustrated, listed and described in 88-page book are 8 sizes and 16 types of variable-speed drives, ½ to 25 hp with manual and automatic controls. Drives of the right specifications for a specific service may be selected from 36-page section "Pre-selected Drives." Installation photos and diagrammatic applications are included. Link-Belt Co.

PUMPS AND ACCESSORIES

Centrifugal Pumps (3A). Single and two stage, size 1 to 5 centrifugal pumps designed for small boiler feed, cooling service, condensate service and many other uses are described in informative bulletin. Specifications, motor data, rating curves and construction materials are included as well as 11-page section entitled "How To Select A Cold Water Pump". Worthington Pump and Machinery Corp.

Service Pumps (3B). Titled "Short Coupled Service Pumps", 16-page bulletin contains cutaway drawings of pump bowls and discharge column. Sketches show the vertical turbine pump applied to river and re-lift service, boosting, recirculation, cooling tower, drainage, gas and oil pumping, and fire pumps. Layne & Bowler, Inc.

Vertical Turbine Pumps (3C). Graphically portraying construction details and various types of drives by the use of large color illustrations, this 20-page bulletin also discusses the wide variety of applications possible with deep-well turbine pumps. Can be furnished for 4-in. or larger wells. Capacities range from 12 to 3,000 gpm. The Deming Co.

Rotary Pump (3D). New general service, screw-type rotary pump, with capacities to 85 gpm and pressures to 150 psi, is described and illustrated in 8-page bulletin. Contains cross-sectional drawing, viscosity tables, dimension drawings and table of standard NEMA motor frames. IMO-DeLaval Products Div. DeLaval Steam Turbine Co.

TOOLS AND SPECIALTIES

Air Cylinders (3E). Presenting latest engineering developments on stationary and rotating air cylinders, a 14-page booklet describes the various models fabricated by this company for controlling air applications. Included are illustrations, cross-sectional drawings and specifications. Logansport Machine Co., Inc.

Hard-Facing Manual (3F). New 40-page booklet tells the complete story of hard-facing. It explains how to select the right alloy and what welding process to use. Gives simple step-by-step instructions for applying the various rods by both the oxy-acetylene and metallic-arc processes. Haynes Stellite Div. Union Carbide & Carbon Corp.

Marking Stamps (3G). Steel stamps for all types of industrial marking applications are described and illustrated in new 4-page bulletin. Heavy or light duty hand stamps for applying straight or curved, and concave or convex markings are included as are dimensions, character sizes and prices. M. E. Cunningham Co.

VALVES, PIPING AND FITTINGS

Air Traps (3H). Selection and installation of air traps for automatic drainage of moisture from compressed air intercoolers, aftercoolers, receivers, separators and drip joints are covered in 4-page bulletin. Illustrations of the complete line of traps, their applications and how they work are presented, together with physical data and list prices. Armstrong Machine Works.

Unions and Valves (3J). Illustrated 20-page catalog includes complete data, specifications and prices on a full line of hot-forged steel unions and check valves. Stainless-steel and alloy-steel unions are covered in addition to single union swing check and spring controlled check valves. Information on a double-union full opening swing-check valve is incorporated. Catawissa Valve & Fittings Co.

Strainers and Separators (3K). Revised 16-page illustrated catalog of Y- and T-Type strainers, suction strainers, multi-flow separators and receiver-separators contains descriptions, dimensions, weights and prices. Technical data on proper type and capacity selection, in addition to engineering information on pressure ratings are included. American District Steam Company.

Seamless Tubing (3L). Well illustrated with photos, drawings and tables, this 16-page booklet gives tolerance, finish and application data on close-tolerance, compression-formed tubing. Details of the forging process are given, together with profilometer reading tables and a drawing covering depth of decarburization. Tube Reducing Corp.

Steam Trap Chart (3M). Bulletin features an illustrated chart for easy selection of right types of steam traps for all applications. Lists advantages and special features for: thermostatic bucket, float, and liquid expansion types. Sarco Co., Inc.

Water Columns and Gages (3N). Full line of sight flow indicators of all types and construction, in addition to gages and water columns of all descriptions are covered in illustrated 4-page bulletin. Specifications and prices are included as well as a complete list of accessories and specialties. Ernst Water Column & Gage Co.

Steam Traps (3P). Information on a line of upright bucket steam and air traps is contained in 4-page bulletin that includes photographs, drawings, and capacity tables. Sizing data and dimensions are also presented in addition to a description of a new Venturo-valve. The C. E. Squires Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Plastic Pipe (3Q). Various applications of plastic pipe in flexible, semi-rigid and rigid types are described in 4-page bulletin that also contains specifications and a general description of the outstanding features. Carter Products Corp.

Pinch Type Valves (3R). Natural and synthetic rubber pinch type valves are thoroughly covered in 16-page catalog that gives performance charts, photographs and schematic drawings. Design and construction are clearly shown and many applications suggested. Flexible Valve Corp.

Tubing Price Increase (3S). Recent price increases on seamless stainless steel tubing were on a net per lb basis. Convenient 52-page conversion table shows the increase per 100 ft. The tabulation includes tubing having weights from 0.1299 through 33.33 lb per ft. The Babcock & Wilcox Tube Co.

Steam Jet Syphons (3T). Full line of steam jet syphons, which utilize the energy of steam under pressure to pump, heat, mix liquids and handle solids, is described and illustrated in 24-page bulletin. Various types, including special purpose and corrosion resistant syphons are thoroughly covered. Design, typical applications, construction and operation are discussed. Sizes,

(Continued on page 118)

You can be sure when a **B&W Refractories Engineer** *recommends boiler refractories*

If you are having trouble with boiler furnace linings . . . if they are causing high maintenance costs and excessive outages . . . consult your B&W Refractories representative. He understands your problems . . . knows their solutions . . . And he can make expert recommendations from B&W's *complete* line of refractories:

HEAVY FIREBRICK

For furnaces with slagging, flame impingement and spalling conditions, either B&W 80 or Junior Firebrick can be used. 80's assure uninterrupted service at extremely high ratings. Juniors are recommended where load bearing and temperature requirements are less severe, but too severe for the best grades of fireclay brick.

INSULATING FIREBRICK

B&W Insulating Firebrick have the lightest weight and lowest heat conductivity of any insulating firebrick in their class. They store and conduct less heat—withstand direct exposure to furnace gases. Available in six types for temperatures from 1600 F to 2900 F.

PLASTICS

Used widely for repairs and for forming special shapes *in place*, B&W *Plastic Moldable* and *B&W Plastic Chrome Ore* offer long life under severe conditions. Plastic Moldable is suitable for use in the great majority of furnaces. It withstands temperatures up to 3000 F. Plastic Chrome Ore is ideally suited for severe slagging conditions.

CASTABLES

In furnaces that require the high resistance of chrome to chemical attack and where speed of installation is important, B&W offers *Kromecast* for temperatures up to 3100 F and *Hydrochrome* for temperatures up to 2800 F.

For burner openings, door linings, walls, roofs and arches, B&W *Kaocast* possesses unusual volume stability and resists spalling. It easily withstands temperatures up to 3000 F.

B&W Baffle Mixes are excellent castables for the construction of monolithic boiler baffles, door linings and other general uses. They are smooth and flow easily, have high strength in small sections. Widely used to withstand temperatures as high as 2600 F.

B&W Insulating Concrete Mixes combine refractoriness, light weight and low heat conductivity with the ability to be poured like ordinary concrete. For temperatures up to 2200 F.

MORTARS

B&W Mortars—Selecting the right mortar is vitally important to long refractory life. B&W Mortars pay for themselves by saving time in application and by satisfactorily performing their jobs under the designed furnace conditions.

For help with a furnace maintenance plan to cut costs and prevent unscheduled outages, call your local B & W Refractories Engineer.

B-371

B&W REFRACTORIES PRODUCTS

B&W 80 FIREBRICK • B&W JUNIOR FIREBRICK
B&W 80 GLASS TANK BLOCKS • B&W INSULATING FIREBRICK
B&W REFRACTORY CASTABLES, PLASTICS AND MORTARS

•

OTHER B&W PRODUCTS

Stationary & Marine Boilers and Component Equipment
Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers
Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

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readers' guide to advertised products

Here you'll find, briefly reviewed, all the booklets and leaflets offered in the advertising columns of this issue of INDUSTRY AND POWER. For easy reference, this listing is divided into various classifications of products. To get your free copies of literature described here and in the corresponding advertisements, turn to Page 37 for a postage-free order card. There, list the Key Numbers of the paragraphs below and mail.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 127. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

2—See page 133. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Send for latest Powermaster catalog. Orr & Sembower, Inc.

3—See page 34. Packaged Steam Generators: New fully illustrated Catalog 202 gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries.

4—See page 137. Packaged Steam Boilers: Send coupon for full information on complete line of packaged steam boilers—fully automatic, 60 to 500 hp plus ample overload. Johnston Brothers, Inc.

5—See pages 54, 55. Integral-Furnace Boiler: This new boiler saves erection time and cost, meets wide range of service, handles quick load changes, fast steaming, low maintenance, easy accessibility. Suitable for outdoor service, burns oil and/or gas saves fuel and space. Write for free Bulletin G-72 The Babcock & Wilcox Company.

CLEANERS AND BLOWERS

6—See page 139. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

7—See page 128. Vacuum Cleaning System: Write for free Bulletin A-794 giving details on 5 hp HOFFCO-VAC portable with improved design for high capacity, continuous cleaning. Bulletin A-803 gives data on gas-engine powered HOFFCO-VAC portable for complete independence of power sources. Another technical bulletin describes 1½ hp HOFF-VAC portable with compact, efficient design. Bulletin A-752 details 3 hp HOFFCO-VAC unequalled efficiency and economy for its size. Data also available on 7½ hp vacuum that provides higher suction for extra-heavy duty cleaning and maximum cleaning efficiency. U. S. Hoffman Machinery Corporation.

8—See page 121. Axial Flow Blowers: Publication No. 88 gives complete information on new precision axial flow blowers. They handle air movement gently by screw action instead of paddle action. Air pulsations and noise reduces to surprisingly low level. Write today. The Standard Stoker Co., Inc.

9—See page 28. Turbine Blowers: Free bulletin gives you complete data on these turbine blowers that combine absolute dependability with complete forced draft efficiency. Minimum cost of operation, simple, rugged, and compact construction, no time and expense required for engineering layout. Write for bulletin. L. J. Wing Mfg. Co.

COMPRESSORS

10—See page 129. Air Compressors: Send today for free folder STF-50; gives complete details on Schramm air compressors. There is a Schramm compressor to fit your every need—providing air where you want it, economically and continuously. Compact, easy to move. Schramm, Inc.

DIESEL POWER

11—See page 30. Smaller, Lighter, Heavy-Duty Diesel Engine: Ingersoll-Rand TS Diesel available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. Extra stamina and dependability of big-engine design. Write today for more information on the new RS Diesel—or for greater power, ask about the well-known S and SS Diesels up to 900 hp. Ingersoll-Rand.

12—See page 51. Superior Diesels: Be sure to read the remarkable success story on page 51 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated 20-page booklet. The National Supply Company.

DUST & FLY ASH COLLECTING EQUIPMENT

13—See page 131. Electrical Precipitation: Write for your free Bulletin 500 which presents full information on the Cottrell Precipitator. It effectively cleans stock gases by removing over 95% of all fly ash particles. Research Corporation.

ELECTRICAL EQUIPMENT

14—See page 48. Time-Delay Fuses: New catalog gives full data on renewable cartridge fuses for protection where time delay is most needed—135 to 200% overloads. Economy Fuse and Mfg. Co.

15—See page 43. Pyranol Capacitors: Write for Bulletin GEA-5167 to see how capacitors can save you money, increase circuit capacity, and improve power factor. General Electric Co.

16—See page 113. Voltage Regulators: Write today for full details on Stabiline Electro-mechanical Voltage Regulators. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings: capacities to 100 KVA. The Superior Electric Co.

17—See page 63. Motor Maintenance Repair: When you have peak periods of rush jobs that push overtime costs to maximum and result in red ink operation, turn to National Electric Coil Company. Write for complete information. National Electric Coil Company.

FLOOR REPAIRS

18—See page 136. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and Hand Book of Building Maintenance. Flexrock Co.

FUELS AND FIRING EQUIPMENT

19—See page 112. Automatic Oil Burner: Wide-range oil-burning system assembled complete on one base for all types of boilers and furnaces from 100 developed hp and up. Write for Bulletin 400 for full details and specifications. Peabody Engineering Corp.

20—See page 15. Fanmix Gas and Oil Burners: Bulletin 410-6 gives complete data on Coppus-Dennis Fanmix burners that allow you to get more heat release per cu ft of furnace volume. Coppus Engineering Corp.

21—See page 27. Baffles: Enco streamlined baffles give you four major values: 1. better heat transfer; 2. low draft loss; 3. less steam, less time for cleaning; 4. custom installation. Write for Bulletin BW44 for full story, with complete engineering data, on how Enco baffles provide maximum steam output with minimum fuel consumption. The Engineer Company.

(Continued on page 28)

You Save on 4 Counts with ENCO STREAMLINED BAFFLES

1 Better heat transfer

Enco's improved baffle design insures a uniform, high velocity gas flow over every square foot of heating surface.

2 Low draft loss

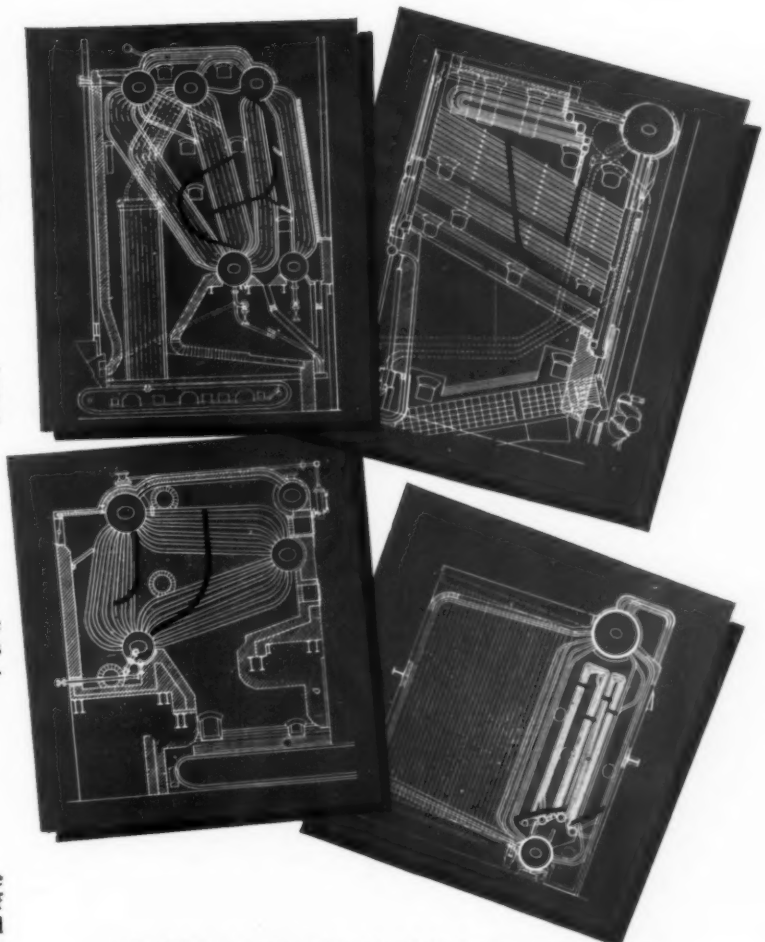
Smoothly curved baffles maintain a cross-flow of gases across the tube banks. Dead gas areas, bottlenecks and eddy currents are eliminated.

3 Less steam, less time for cleaning

Soot doesn't get a chance to accumulate in pockets. Soot blowers are used less often. Streamlined baffles lower maintenance costs.

4 Custom installation

Experienced Enco crews take charge of the installation, repairs and replacements of your individually designed streamlined baffles—do the job thoroughly and quickly with minimum downtime.



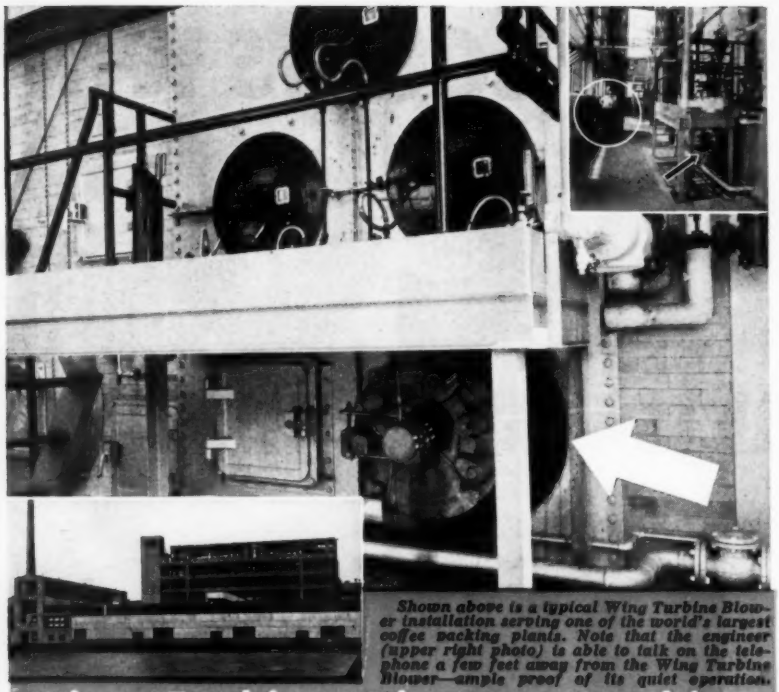
BULLETIN BW44 tells the full story, contains complete engineering data, explains how Enco Baffles provide maximum steam output with minimum fuel consumption. WRITE FOR YOUR FREE COPY TODAY!

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, NEW YORK

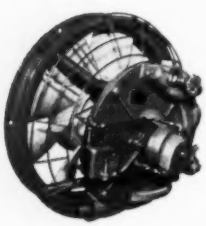
IN CANADA: F. J. RASKIN, LTD., 4220 IBERVILLE ST., MONTREAL 34 P.Q.

EC-481



Shown above is a typical Wing Turbine Blower installation serving one of the world's largest coffee packing plants. Note that the engineer (upper right photo) is able to talk on the telephone a few feet away from the Wing Turbine Blower—ample proof of its quiet operation.

Wing Turbine Blowers Combine Absolute Dependability With Complete Forced Draft Efficiency



In addition to these prime requisites, Wing Turbine Blowers have many extra money saving features including minimum cost of operation, simple, rugged, and compact construction, and because little or no duct work is required, no time and expense is required for engineering layout. Where plants can make use of the low pressure steam from the Wing Turbine Blower for such uses as feed water heating, process work, or space heating, the forced draft is obtained at negligible cost.

L. J. Wing Mfg. Co.

139 Vreeland Mills Road, Linden, N. J.
Canadian Factory: Montreal

WING

Wing

AXIAL FLOW BLOWERS

READERS' GUIDE

(Continued from page 26)

HEATING, VENTILATING AND AIR CONDITIONING

22—See page 33. Unit Heaters: Catalog 16C-1 describes Fedders Series 16 Downblow unit heaters. Catalog 15C-4 gives you complete details on Fedders Series 15 Horizontal Unit Heaters. Send for your copies today. Fedders-Quigan Corp.

23—See page 142. Help With Your Air-Moving Job: Now you can take full advantage of Hartzell engineering, longest experienced in the propeller-type fan industry, to work on your air-moving problems. See page 142 for coupon which offers you this free service. Hartzell Propeller Fan Co.

24—See page 11. Electric Immersion Heaters: These electric immersion heaters give maximum performance for heating water, oils, waxes, heat-transfer mediums and other liquids. Chromalox heaters come in full range of types for permanent or portable use. Quickly and easily installed with minimum labor and material costs. Write today for 48 page Chromalox Catalog. Edwin L. Wiegand Company.

HEAT EXCHANGERS

25—See page 116. Cooling Towers: Small and medium-capacity cooling towers, either induced draft or natural draft can be shipped from stock. Write for further data. J. F. Pritchard & Co.

26—See page 125. Heat Exchangers: Provide faster, more accurate cooling of liquids to specified temperatures. With evaporative principle, they consume less than 5% of water ordinarily used. Send for Bulletin No. 96 for complete details. Niagara Blower Co.

INSTRUMENTS

27—See page 135. Flow Indicators: Write for Bulletin S-1 for specifications of Ernst Sight Flow Indicators. Bulletin also contains details on gage glass guards of non-breakable plastic, flat gage glasses, caliperated gage glasses, rubber gage glass gaskets. Ernst Water Column & Gage Co.

28—See page 138. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

29—See page 127. Gages: These gages give you clearest visibility for longer periods of time due to a new coating on glasses. Coating is new special compound. Makes gage glasses far less subject to fouling through foreign matter adhering to glass. Jerguson Gages easier to service, too. Information provides data units on Jerguson gages and valves. Jerguson Gage & Valve Company.

30—See page 67. Circuit Tester: Model 785 gives you maximum, all around performance. 28 ranges in one case locates circuit troubles on production equipment in the shop; checks electrical equipment during manufacture on the

(Continued on page 30)

HOSE PROBLEMS GET THE AIR

QUAKER HOSE LASTS FIVE TIMES AS LONG

Hundred degree temperatures and plenty of twisting, crushing and abrasion were killers to air hose in a Texas installation. The usual air hose lasted only two or three weeks.

Then QUAKER Blue Devil Air Hose was connected to the compressors. The result! Seventeen weeks of continuous, rugged service and QUAKER was still on the job. Life expectancy of this hose . . . at least 25 weeks!

Performance like this is typical of QUAKER Hose throughout industry—and that's why QUAKER Hose is standard equipment in leading plants throughout the country.

QUAKER'S full line of pre-tested hose meets every industrial requirement.

BELTING FOR LOWER-COST HANDLING

Regardless if you are moving bulk materials or package goods, there is a QUAKER Conveyor Belt to do the job.

PACKING WITH THE POSITIVE SEAL

QUAKER Packings are engineered for every industrial application—for pumps, compressors, water, air and steam lines.

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READERS' GUIDE

(Continued from page 28)

bench; 28 ranges immediately available for research and development work in the lab. Write for full information. Weston Electrical Instrument Corp.

31—See page 132. Flow Meters: Flo-Watch gives you full story on boiler feedwater in single, space-saving instrument. Records, totals, indicates flow. Mechanically actuated—responds accurately to flow through Venturi Tube nozzle, or orifice plate. Write for bulletins and complete information today. Builders-Providence, Inc.

INSULATION

32—See page 109. Blanket Insulation: Send for new booklet on B-H Blanket Insulation with interlocking fibers for maximum moisture resistance. Low cost large area flexibility. Baldwin-Hill Co.

33—See page 134. One-Coat Insulation: Send for Bulletin I-85 on this new one-coat insulation finish that lets you trowel to a smooth hard finish without cracks in one coat. Practically no shrinkage. Highly adhesive. Serviceable at temperatures up to 1700° F. Write today. Refractory & Insulation Corp.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

34—See page 123. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

35—See page 41. "11 Ways to Cut Production Costs": Write for your copy of free, new booklet which is yours without obligation. You will find handy coupon on page 41. Alemite Corporation.

36—See page 137. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corp.

37—See pages 35, 35. Industrial Oil: Multi-purpose Stanoil, gives you clean, effective lubrication, holds bearing upkeep cost to minimum. You can depend on Stanoil for clean, maximum performance service in hydraulic units, speed reducers, and circulating systems. You can depend, too, on expert, on-the-spot service of the Standard Oil lubrication specialist. Write for full information on Stanoil Industrial Oil, Stanicut Cutting Oils, Stanicool Hd Soluble Oils, Stanostamp Compounds, and Stanorust for maximum protection against rust. Standard Oil Company (Indiana).

38—See page 103. Colloidal Graphite: New Bulletin No. 424 brings you up-to-the-minute descriptions of 141 uses for Colloidal Graphite in industrial lubrication. **"dag"** colloidal graphite is slipperier than oil—perfect for assembly and run-in, and for high temperature applications. Be sure to write today for this highly interesting and helpful bulletin. Acheson Colloids Corporation.

MAINTENANCE

39—See page 133. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 Illustrations. Send today for your copy. Smooth-On Mfg. Co.

40—See page 39. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corporation.

41—See page 140. Flexible Abrasive: Cleans like an eraser—gentle, fast action quickly removes surface imperfections with minimum cutting. Cleans commutators, gives burnished finish to commutators after grinding. Write for new, free 40 page handbook "Commutator and Slip Ring Maintenance". Ideal Industries, Inc.

MATERIAL HANDLING

42—See page 119. Pneumatic Conveyors: Write today for full details proving pneumatic conveyors can reduce your handling costs. You have less labor cost, no material waste, and better working conditions. Dracco Corp.

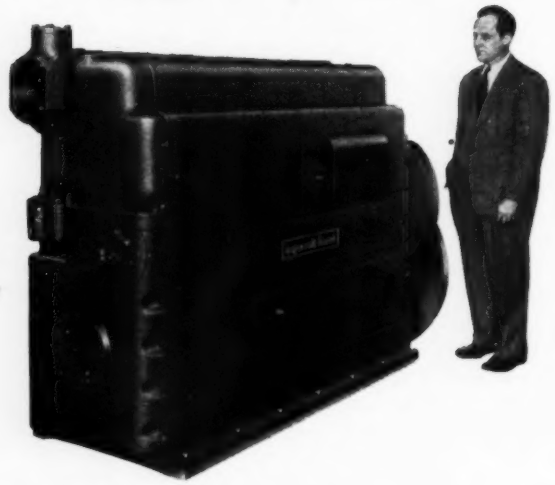
43—See page 138. Car Pullers, Barge Movers: Electric, gasoline, diesel. Write for full information on power-driven capstans, gypsies, and single and double winches for all materials-handling applications. Silent Hoist & Crane Co.

44—See page 66. Skip Hoist: Gives you practical solution to the problems of conveying coal and coke to producer storage. The skip bucket keeps the

(Continued on page 32)

Only the

NEW IR DIESEL



195 to 375 horsepower

. . . gives big-engine features in a small package

Here's the smaller, lighter, more efficient, 4-cycle, supercharged heavy-duty diesel you've been waiting for . . . the TS engine. It's portable . . . but not automotive. Weighs only 30 lb per hp . . . yet operates at 900 to 1000 rpm. Consumes only 0.40 lb of fuel per hp-hr . . . yet has small, 7" by 8½" cylinders. Perfect balance . . . but no balancing devices.

Compare the new Ingersoll-Rand TS with any other diesel for size, economy, and performance—and you'll agree it is the greatest advance in engine design in the past decade. Ideal for cranes, shovels, derricks, pumps, generators, and all types of stationary and portable applications. Send for complete information today.

Ingersoll-Rand 506-7

11 Broadway, New York 4, N. Y.

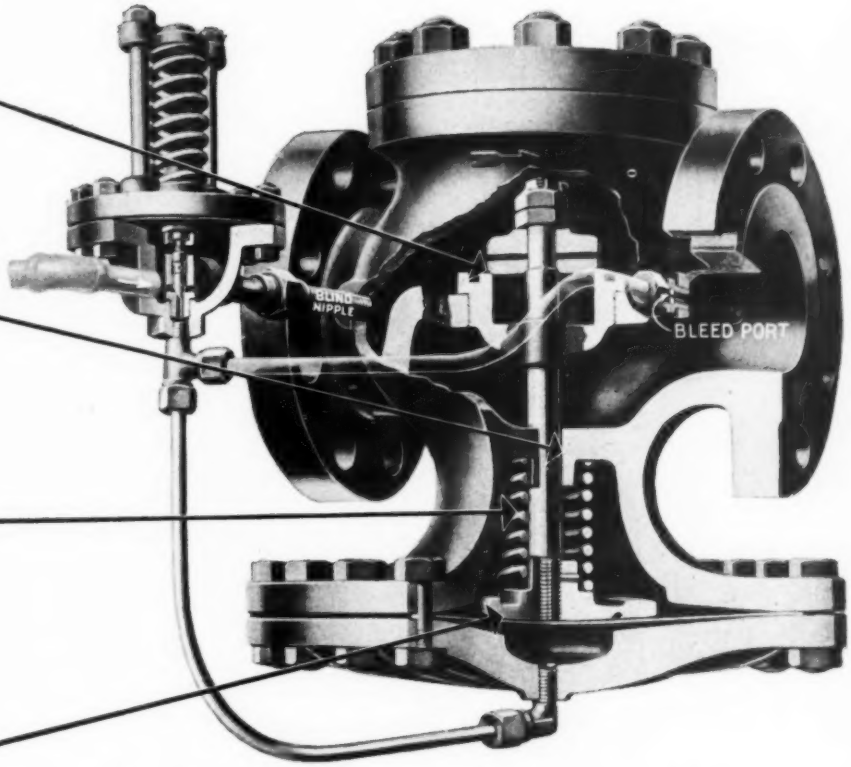
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator-operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SE-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

READERS' GUIDE

(Continued from page 30)

producer-storage bin filled at all times. Write for information about G-W's free non-obligatory service of surveying your present method of moving materials. Gifford-Wood Co.

45—See page 62. Conveyors: If you have a conveying problem, write or call Fuller Company today. Complete information and engineering advice available with no obligation. Maximum service equipment—the Airveyor, for instance, is used for conveying clay. Unloading rate—10 tons an hour. Same system reclaims clay from storage bins and delivers to supply bin through remote control. Fuller Company.

46—See page 139. Freight Elevators: You're sure of superior construction and plus-performance with Reading Freight Elevators — hydraulic, electric or self-supporting drum machines. Write for full data. The Reading Elevator Co., Inc.

PACKINGS AND GASKETS

47—See page 130. Palmetto Packing: Write for free Bulletin MP-20. Gives full details on this new packing. Dependable, tailored performance — fabric and binder varied to match your service condition. Uniform, heavier wall construction. Each ring sits squat and true. Will not split at the hinge, no raw edges to fray. Greene, Tweed & Co.

48—See page 58. Bulk Materials Handling Systems: Long experience has given Stephens-Adamson Engineers the "know-how" that cracks bulk materials handling problems quickly and economically. Their staff is at your service. Write them today. Stephens-Adamson Mfg. Co.

PIPE AND FITTINGS

49—See page 132. Flexible Metallic Hose: "Atlantic" metal hose survives most extreme conditions. Seamless or interlocking flexible metal hose in bronze, steel, stainless steel, monel. Standard or special couplings. Write for Catalog 100. Atlantic Metal Hose Co., Inc.

50—See page 126. Ball-Bearing Swivel Joints: Catalog No. 50 gives full information on more than 500 different types, styles and sizes Chiksan Ball-Bearing Swivel Joints. Write today. Chiksan Company.

51—See page 45. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass Company.

52 — See page 130. Pipe Fabricating Specialists: Meet your most exacting specification with absolute satisfaction on all pipe fabricating for Oil, Chemical, Concrete, Asphalt, and other industrial requirements. Albert Pipe Supply Co., Inc.

PLANT EQUIPMENT

53—See page 136. Uni-Truks: Send for Form 757-1. Gives complete information on these hand trucks. One and two-handle models. Uni-Truks are made of Heavy pressed steel, triple-welded to frame, for extra strength at greatest stress. Uni-Truks get more work done faster. Standard Pressed Steel Co.

POWER TRANSMISSION

54 — See page 57. Multi-V-Drives: Write for latest bulletin on Worthington Multi-V-Drives—gives you full explanation of how 15 exclusive, or original, features including the Worthington QD Sheaves will save you money. Send today. Multi-V-Drive Sales Division, Worthington Pump & Machinery Corp.

55—See page 70. Rubber Transmission Belts: Bulletin 6808 H is packed with detailed data on belting applications and explains the compensation principle developed by this company's engineers to equalize ply stresses. Raybestos-Manhattan, Inc., Manhattan Rubber Division.

56—See page 49. Roller Chains: New "BA" assembly roller chain has all advantages of riveted roller chain plus even greater ease of field assembly and disassembly. Write for Bulletin 50-6 for all facts on "BA" assembly. Chain Belt Company, Baldwin-Duckworth Division.

57—See page 107. V-Belts: The complete Vulco-Rope line with money-saving "concave side", includes a variety of types designed to fit specific requirements. Write for further information. The Gates Rubber Company.

58—See page 136. Fan-Cooled, Worm Gear Speed Reducers: Write for Catalog 200 for standard drives, and Catalog 300 on Speedaires that do more work, deliver double the horsepower of standard worm units of same frame size. Save money, space, and weight. The Cleveland Worm & Gear Co.

59—See page 40. Chains: Popular types and sizes available immediately from stock. Large assortment of sprockets, gears, pulleys, babbitted bearings and other transmission items are also available. Write for full information. The Jeffrey Manufacturing Company.

PUMPS

60—See page 65. "How To Get Longer Service From Your Pumps": That's the title of a booklet that belongs in the files of every man concerned with operating, maintaining, or purchasing pumping equipment. Be sure to write for your copy now. The International Nickel Co., Inc.

61—See page 110. Weinman Pumps: Designed and manufactured by Centrifugal Specialists who are concerned with but one product . . . pumps that work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. Write today. The Weinman Pump Mfg. Co.

62—See page 117. Direct Flow Pumps: New Aldrich 100 hp reciprocating pump has through-flow, close clearance design that's extremely simple which cuts down maintenance costs. Interchangeability of wearing parts, less costly pump housing and lower foundation expense. Write for free Data Sheet 64. Gives you full information. The Aldrich Pump Company.

REFRACTORIES

63—See page 122. Boiler Seam Protector: Bulletin describes a durable, refractory girth seam protector which will stop further leaking and fire-cracking on old seams; prevent leaking and fire cracking on new seams. National Boiler Protector Co.

64—See page 25. Refractories: Write for details on the B & W Refractories. Learn how they can cut operating costs in all types of industrial furnaces—large or small. The Babcock & Wilcox Co.

REGULATORS AND CONTROLS

65 — See page 13. Combustion Safeguard: Fireye is the safe, modern electronic combustion safeguard for oil, gas, and pulverized coal burners. Provides continuous monitoring of oil or gas flame, programming control for automatic ignition systems, boiler water level control and low level safeguard. Write for Bulletin 604-C for complete details. Combustion Control Corp.

66—See page 134. Regulators: Type G has valves located at end instead of below the float chamber. This cuts down working parts by one-third — saves maintenance costs. Available in either a piston or an orifice valve unit. Simple, compact design; for w.s.p. up to 250 lbs; another model from 300 to 400 lbs. Write for free bulletin No. 150 on Stets Type G Regulators and complete line of liquid level controllers. Stets Company.

67 — See page 61. Thermostat and Diaphragm Regulating Valve: New Leslie thermostat features greatly increased throttling range, bi-metallic element, simple rugged construction. All work together for economic reliable control of cooling water. Write for Bulletin 464-B. It gives complete descriptions. Leslie Co.

68—See page 139. Temperature Regulators: Write for Stacon Bulletin 50-1000 outlining full details on this extra sensitive, accurate, economical temperature regulator. Permits temperature regulation to plus or minus one degree Fahrenheit! Farris Stacon Corporation.

69—See page 23. Bucket Steam Traps: Sarco's Steam Traps and Temperature Controls improve production—save in fuel costs! They give you heat where you want it, when you want it, never too much or too little. Write for Catalog No. 350 with complete information on these traps. Sarco Company, Inc.

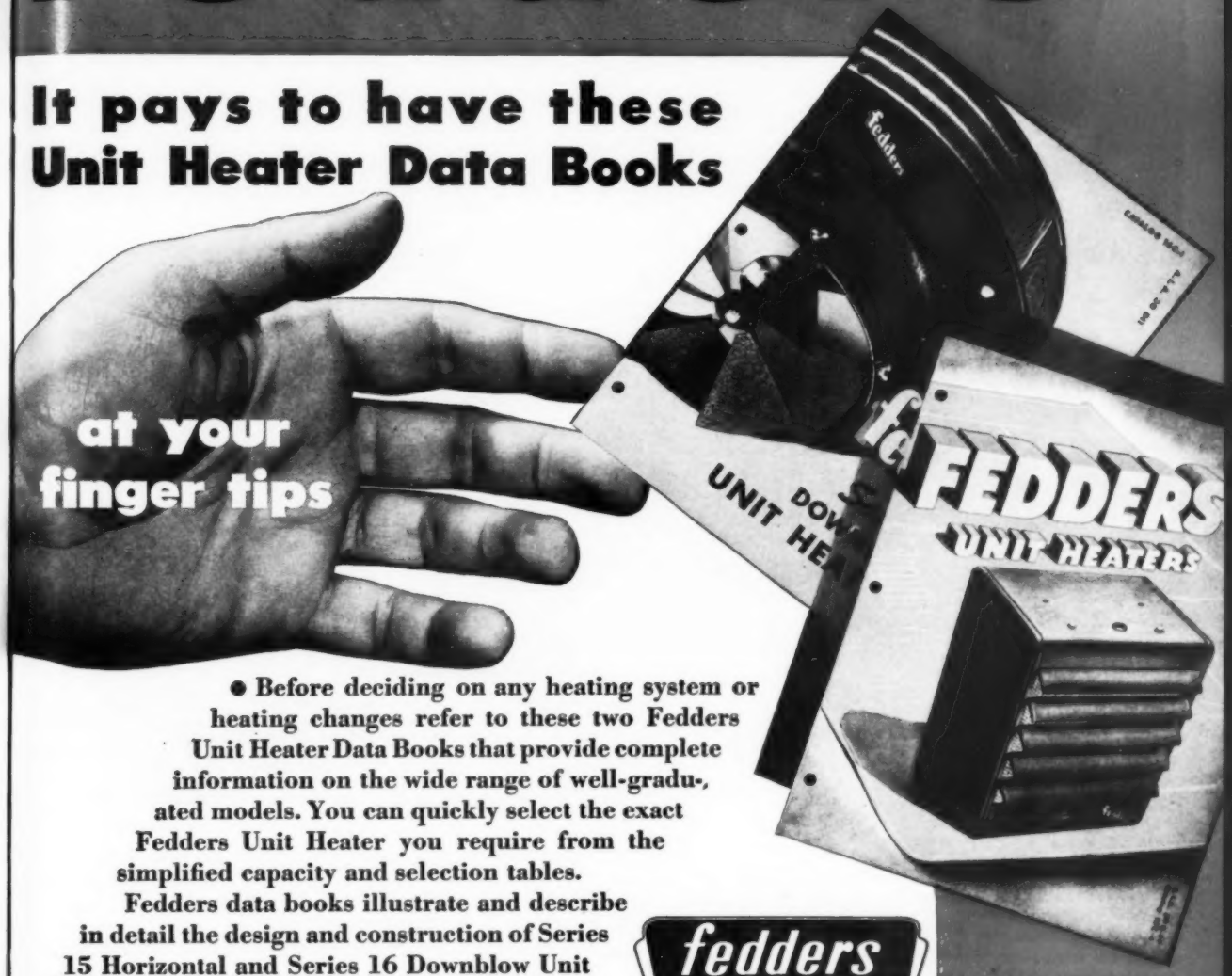
70—See page 111. Steam and Water Mixers: Write for free Bulletin 358-S on these steam and water mixers—they give you a small, localized supply of warm or hot water. Economical — quickly pay back their cost. Easy to install. Requires steam and water pressures above 10 lbs. The Powers Regulator Co.

71—See page 31. Pressure and Temperature Regulators: Bulletin 350 gives you complete details on Spence regulators. Type EQ has SECO metal seats and discs that resist wiredrawing; packless construction to minimize friction and cut down maintenance; spring is

(Continued on page 37)

fedders

It pays to have these Unit Heater Data Books



● Before deciding on any heating system or heating changes refer to these two Fedders Unit Heater Data Books that provide complete information on the wide range of well-graduated models. You can quickly select the exact Fedders Unit Heater you require from the simplified capacity and selection tables.

Fedders data books illustrate and describe in detail the design and construction of Series 15 Horizontal and Series 16 Downblow Unit Heaters for use on steam or hot water lines.

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A Great Name Since 1896

Write TODAY for your copies of Fedders Unit Heater Catalogs 15C-4 and 16C-2.

FEDDERS-QUIGAN CORPORATION
BUFFALO 7, N. Y.

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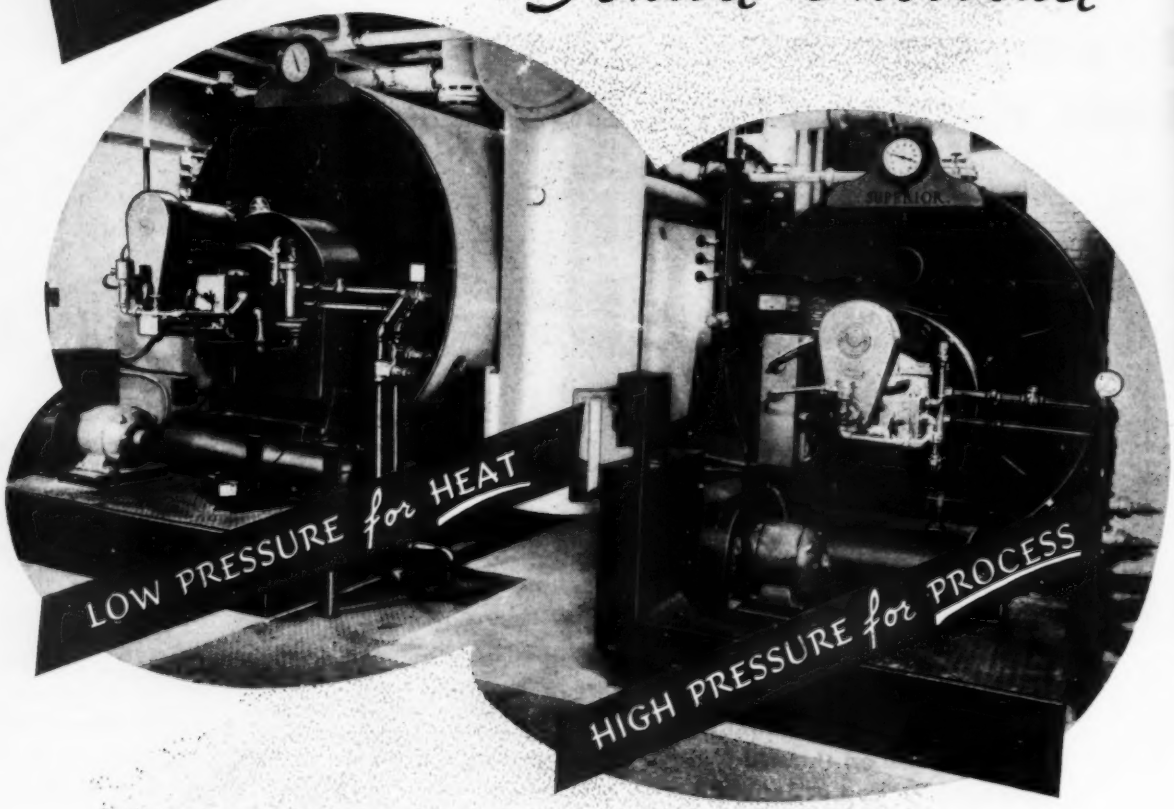
Superior
STEAM GENERATORS

at the
PHILADELPHIA
Textile Institute



In search of new techniques and lower operating costs (of which cost-of-steam is an important factor) the Philadelphia Textile Institute conducts constant research for the Textile Industry . . . and for their new Scholler Laboratories, where much of this research is carried out, Superior Steam Generators were chosen because of their recognized economy of operation and low cost steam production. The two units shown supply heat for the entire building and process steam for Scholler Laboratories, as well as for Althouse and Burlington Laboratories. If you use steam for heat or process, you'll want the details given in Superior Steam Generator Catalog 202.

18 sizes from 20 to 600 bhp. • Fully automatic with any grade of oil, gas, or both. • More than 80% thermal efficiency guaranteed.

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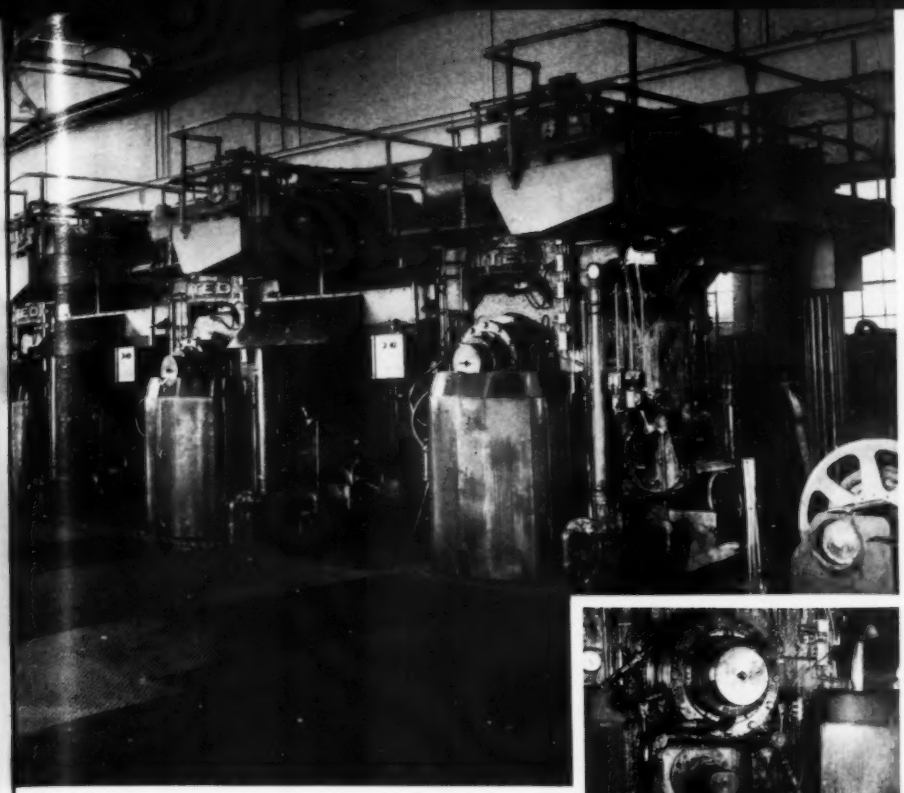
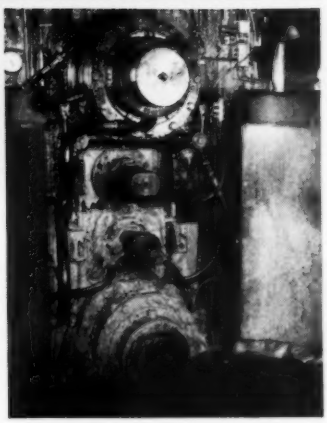
Factory Emmaus, Pa
Executive Offices Times Tower, Times Square, New York 18, N. Y.





Putting the "squeeze" on maintenance costs

IN this modern 5-stand tandem cold-rolling mill at a midwest steel mill, giant backup rolls squeeze strip steel to thousandths of an inch thickness. Taking the brunt of this punishing work are the end bearings on the rolls. Protection and proper operation of these bearings call for a lubricant that can really take it.

Recommended by a Standard Oil lubrication specialist, a STANOIL Industrial Oil has been used on these bearings for 1½ years of hard, continuous operation. Clean, effective lubrication, together with excellent maintenance practices by mill operators, has held bearing-upkeep costs to a minimum. The oil-circulating system, which includes two 6,000-gallon oil tanks, has remained entirely clean. STANOIL has shown practically no deterioration in use.

You can rely on this unique multi-purpose oil to give you the same, clean, dependable service in hydraulic units, speed reducers, and circulating systems. You can rely, too, on the expert, on-the-spot service of a Standard Oil lubrication specialist. How you can obtain his help, quickly and easily, is explained at the right.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

STANOIL
TRADE MARK
Industrial Oil

What's YOUR problem?

Warren Erickson, Lubrication Engineer at Standard Oil's Chicago office, helped this midwest steel mill (see left) make important savings through the use of STANOIL Industrial Oil on a cold-rolling operation. He was close at hand, gave mill operators engineering service when they needed it.

There's a corps of Standard Oil Engineers and lubrication specialists throughout the Midwest. You'll find one located near your plant. You can reach him simply by phoning your local Standard Oil Company (Indiana) office. His experience and special training will help you get maximum benefits from STANOIL and other outstanding products such as:

STANICUT Cutting Oils. These special-duty cutting oils meet today's most exacting requirements and highest production schedules. Grades vary in viscosity and compounding. Each contains the correct proportion of extreme-pressure and friction-reducing ingredients.

STANICOOL HD Soluble Oils. Because of additional compounding, these heavy-duty soluble oils possess the cooling ablity of an emulsion and also give better tool life and finer finishes than do conventional soluble oils.

STANOSTAMP Compounds. These widely accepted products have demonstrated their ability to handle heavy stamping or drawing operations of low-carbon or alloy steels. Each of the three grades is a paste compound to which water can be added to provide the most economical applications. STANOSTAMPS offer maximum protection for dies and work, can be readily removed in conventional washing equipment.

STANDARD OIL COMPANY (INDIANA) STANDARD

What's YOUR problem?

● Troubled with fingerprint corrosion? Are parts rusting between machining and assembly? Do you get customer complaints because of rusted shipments? These and a score of other troublesome problems can be eliminated with the use of the right STANORUST Rust Preventive.

To help you get the maximum benefit from the STANORUSTs, Standard Oil has a corps of lubricating specialists located throughout the Midwest. One of these men is near your plant. You can get his services quickly and easily. His wide experience and special training in rust prevention will help you make real savings. Why not arrange today for his visit by calling the nearest Standard Oil (Indiana) office?

8 grades of STANORUST

STANORUST No. 3-FP
is a fingerprint remover. It can be used to eliminate the cause of fingerprint corrosion and to deposit a protective film in one simple dipping operation.

STANORUST No. 4-V
has a Stoddard-solvent base which evaporates to leave a thin film for temporary rust prevention.

STANORUST No. 12
provides economical protection under average indoor conditions. It can be applied cold.

STANORUST No. 95
is designed for protection of parts in moderately severe indoor storage. It also can be applied cold.

STANORUST S-1
is a semi-fluid product, designed to give protection over a longer period than the No. 95 grade. It is suitable for outdoor service, if parts are under cover.

STANORUST 1-XC
is a non-fluid product which is recommended for protection of parts under severe outdoor conditions. It has been thinned with a volatile solvent and can be applied cold with a swab or brush.

STANORUST 3-X
is a soft, grease-like product and offers protection against severe indoor storage and moderately severe outdoor conditions.

STANORUST 6-X
is a heavy, petrolatum-type product that protects against the most severe outdoor exposure. It meets a government specification which includes a requirement that it protect against corrosion for a period of not less than 10 years without renewal.

For maximum protection against rust . . .

● STANORUST Rust Preventives offer maximum protection against rust because they contain a moisture-displacement additive which makes them far superior to straight mineral oils or to petrolatums frequently used for rust prevention.

The STANORUSTs have been thoroughly tested and proved effective on a wide variety of rust prevention jobs, ranging from elimination of fingerprint corrosion to protection of equipment under severe outdoor storage conditions.

The complete STANORUST line is briefly described at the right. The booklet offered will bring you complete details. You can secure a copy by calling the local Standard Oil (Indiana) office or by writing 910 South Michigan Avenue, Chicago 80, Illinois.

STANORUST
REG. U. S. PAT. OFF.
RUST PREVENTIVES

SEND FOR THIS BOOKLET

STANDARD

STANDARD OIL COMPANY (INDIANA

READERS' GUIDE

(Continued from page 32)

out of steam path—operates at low unit stress for long life; large balanced diaphragm. Write today. Spence Engineering Company.

STEAM TURBINES AND ENGINES

72—See page 69. Terry Turbines: Any Terry district representative will gladly give you full information on a turbine to meet your requirements, no matter how special they may be. Or write directly. No obligation. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

73—See page 122. Knife Blade Cutter Wheels: Machined from special alloy tool steel, oil tempered and hardened, these cutter wheels come in sizes and types for all makes of pipe cutters. Write for catalog. Armstrong Bros. Tool Co.

74—See page 115. Tube Cleaning and Expanding: Write for sound advice and top service on your tube cleaning and tube expanding problems. Airetool products help you cut down time, give lower maintenance cost, more thorough scale removal. Airetool Manufacturing Company.

75—See page 120. Small Tube Cleaners: With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. No leakage. No stalling at low speeds. Send for ROTOJET Junior Bulletin. Elliott Company—Roto Division.

76—See page 135. Tube Cleaners and Expanders: Bulletin 47-A contains complete information on Wilson standard tube cleaners that fit your special needs. Bulletin 380 for data on general tube expanders. Specify bulletins you want. Thomas C. Wilson, Inc.

77—See page 122. Belt Fasteners: Write for free circular on belt fastener No. 500. Heavy duty, they make strong, flexible joints and conveyor belts of any width and of from 3/16 to 1/2" thickness. Easily applied on the job or in the shop. Special design gives deep compression into belting and smooth flush joint. Armstrong-Bray & Co.

78—See page 6. PROTO Tools: New PROTO puller screws have live center tips to prevent shaft damage. Five jaws have holes to allow bolting together—save cost of extra long jaws. Write for catalog of these new PROTO pullers. Plomb Tool Company.

TRAPS, STRAINERS AND SEPARATORS

79—See page 21. Pipe Line Filters: Staynew Double Action Pipe Line Filter's exclusive double action principle guarantees both clean and dry air. You get, in one unit, both mechanical separation and filtration. Complete data will be sent on request. Dollinger Corp.

80—See page 2. Steam Trap Handbook: Tables, charts, diagrams and rules for selecting traps, giving complete explanations, make the new 36-page book a handy reference volume for every engineer's library. Send for Armstrong Steam Trap Book. Armstrong Machine Works.

81—See page 143. Impulse Steam Trap: Discharge continuously under heavy loads, quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for details. Yarnall-Waring Co.

82—See page 114. Steam Traps: Easily installed Nicholson steam traps discharge air as efficiently as water; no air grinding; hardened stainless steel valve. Lengths, 18" to 40"—pressures, 0 to 250 lbs. without change of valve or seat. Write today for free Catalog 250. W. H. Nicholson & Co.

83—See page 118. Strainers: Safeguard your equipment, prevent possible shutdowns with Masoneilan Strainers. They protect pressure regulators, shut-off valves and other apparatus by screening out dirt, chips and other foreign matter. No leaks, no buckle screen, can easily be removed for cleaning. Sizes 1/4" to 1 1/2" bronze; 2" cast iron, screwed connections, 2" to 4" cast iron, flanged connections. Write for more information. Mason-Neilan Regulator Co.

84—See page 7. Helico-Centrifugal Separators: Bulletin S-14-C describes these Swartwout separators that assure 99% dry steam or better with negligible pressure drop. Bulletin S-16-C describes exhaust heads employing same principle as separators, and remove moisture and oil from exhaust steam, prevent rotting of roof and walls in warm weather and ice formation in winter. Airfuge Bulletin S-13 gives full details on Swartwout Airfuge air separator. Simple, float-operated trap releases accumulated liquids automatically—maintains level sufficient to effect seal. Write today. The Swartwout Co.

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers or letters of the paragraphs describing the items you want in the spaces provided on cards.

To: INDUSTRY AND POWER, St. Joseph, Michigan **September, 1950**

Please have forwarded to me, at no obligation, the literature I've indicated by the following Key Numbers and Letters:

Advertised Products Numbers begins Page 26	*New Equipment Numbers begins Page 9*	*New Bulletin Letters begins Page 20*

Your Name_____ **Title**_____

Your Company_____

Co. Address (St. & No.)_____

City_____ **State**_____

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VALVES

85—See page 56. Drop Forged Steel Gate Valves: Series 12100 for 150-800 pounds service. ¼" to 2", has round bolted bonnet, bolted gland. Henry Vogt Machine Co.

86—See page 123. Butterfly Valves: Write for Catalog describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 72". Pressures to 125 psi. W. S. Rockwell Company.

87—See page 8. Piping Layouts: A new book of Jenkins Practical Piping Layouts—Nos. 26 to 50—is in preparation. Write for your copy. Jenkins Bros.

88—See page 52. New Valve Design: Chapman Valve List 960 has been improved to give more than 50% increase in strength of stem and wedge gate connection. Valve stems and gates with new connection are interchangeable with all List 960 valves now in service. Write for complete information. The Chapman Valve Mfg. Co.

89—See page 59. Steel Gate Valves: Body and bonnet have heavy metal sections, ample reinforcements at points under greatest stress. Straight-through ports assure minimum turbulence, erosion, and resistance to flow. See your No. 49 Crane Catalog. Crane Co.

90—See page 104. Valves: Breech-lock valves are your insurance against excessive valve maintenance. Gaskets, rings, flanges, and bolting have been eliminated from these Lunkenheimer breech-lock valves. Bodies and bonnets locked securely together with intermeshing lugs to carry full internal pressure. Write for full information. The Lunkenheimer Co.

91—See pages 46, 47. Blow-Off Valves: Be sure to write for full Bulletin B-424 and Bulletin B-433 for complete information on Yarway Unit Tandem Valve. More than 15,000 boiler plants in U. S. and other countries use Yarway Blow-Off Valves—that's a record to remember! Yarway pioneers and improves blow-off valves and blow-off valve service for both high and low pressure applications. Yarnall-Waring Company.

92—See page 138. Valve Plugs: Write for free catalog giving full information on valve plugs that produce skin-tight, bone-dry closure — plug-face conforms and seals even if valve-seat is worn or if it harbors scale or foreign matter. DeZurik Shower Co.

93—See page 3. Safety Valves: For full details on the design and construction features that enable Foster 38-SV Safety Valves to outperform ANY other safety valve, get in touch with your Foster Representative or Write directly to Foster Engineering Company.

94—See page 134. Poppet Valves: Write today for new bulletin V-11. Gives full description of H & T Poppet Type Multiport Valves for manual, semi-automatic or fully automatic zeolite water softeners or pressure filters. Hungerford & Terry, Inc.

WATER TREATMENT

95—See page 127. Water Treatment: Write for detailed information about solving your water treatment problems. This complete service includes each step from original survey of problem to installation of water purification equipment. General Filter Co.

96—See page 64. Water Conditioning System: Write for full facts concerning this system that gives you, in less space, all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Send for Bulletin W-212-B2. Worthington Pump & Machinery Corp.

97—See page 17. Cuno Flo-Klean Filter: Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in as short a time as a year. See page 17 for coupon which offers complete information without obligation on Cuno Flo-Klean for your particular application. Cuno Engineering Corporation.

98—See page 141. Santobrite Algaecide: Maintains cooling tower efficiency by preventing sluggishness and obstructions in the circulating system. No special equipment is required. Send for Bulletin 0-15. Organic Chemical Div., Monsanto Chemical Company.

WELDING EQUIPMENT

99—See page 60. Prest-O-Lite Equipment: No cylinder oxygen is required to get flame temperatures as high as 2800° F. Further information on request. The Linde Air Products Co.

MISCELLANEOUS

100—See page 137. Check This Economy Move: Over 1900 firms supply the more than 33,000 products which Hajoca stocks for industry. Use this one source and eliminate your high cost of dealing with many sources of supply for the industrial products you use. Hajoca Corporation.

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers or letters of the paragraphs describing the items you want in the spaces provided on cards.

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Your Company_____

Co. Address (St. & No.)_____

City_____ **State**_____

STOP RUST!

YOU can STOP RUST . . . PREVENT RUST...on *any* rustable metal surface with RUST-OLEUM. Every day, rust eats away on your metal tanks, buildings, fences, stairs . . . everything metal inside and outside your plant. Yet, rust *can* be stopped and protection given economically with RUST-OLEUM.

For more than a quarter of a century RUST-OLEUM has been *proved* under severe conditions of weather, fumes, salt air, salt spray, and other rust producing conditions. Railroads, shipyards, builders, refiners . . . nationally known users* in almost every field of industry . . . have found RUST-OLEUM the economical way to stop rust and prevent further rust. Architects, builders, engineers, maintenance men now specify RUST-OLEUM for primer, "shop coat", and finish coats.

RUST-OLEUM adds extra life to metal buildings, equipment and other metal surfaces and can be applied over already rusted surfaces without extensive surface preparation. Yet, RUST-OLEUM costs no more than most quality materials.

RUST-OLEUM not only protects — it beautifies as well! RUST-OLEUM is available in a large selection of colors including aluminum and white. It spreads evenly . . . and dries free of brushmarks in 4 to 12 hours, depending on conditions, to a tough, pliable film that protects against rust.

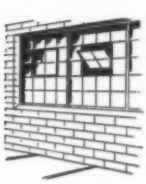
Be sure you get *only* genuine RUST-OLEUM for positive protection against rust! Specify RUST-OLEUM to your contractor or architect on any new construction, remodeling or maintenance work.

RUST-OLEUM is stocked and sold by leading industrial distributors in all principal cities of the United States and Canada. See Sweets for complete catalog and nearest source of supply, or write us direct for complete information.

**Names on request*

RUST-OLEUM CORPORATION

2474 OAKTON STREET — EVANSTON, ILLINOIS



CHAINS *from* STOCK

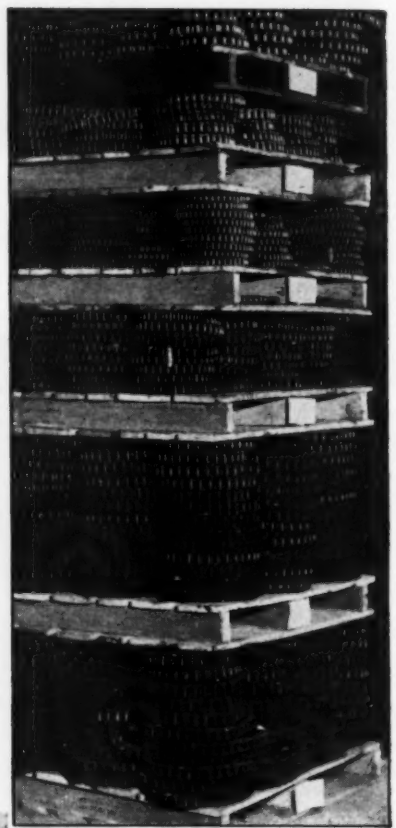
Popular types and sizes available at once from Columbus—from our distributors in all industrial centers

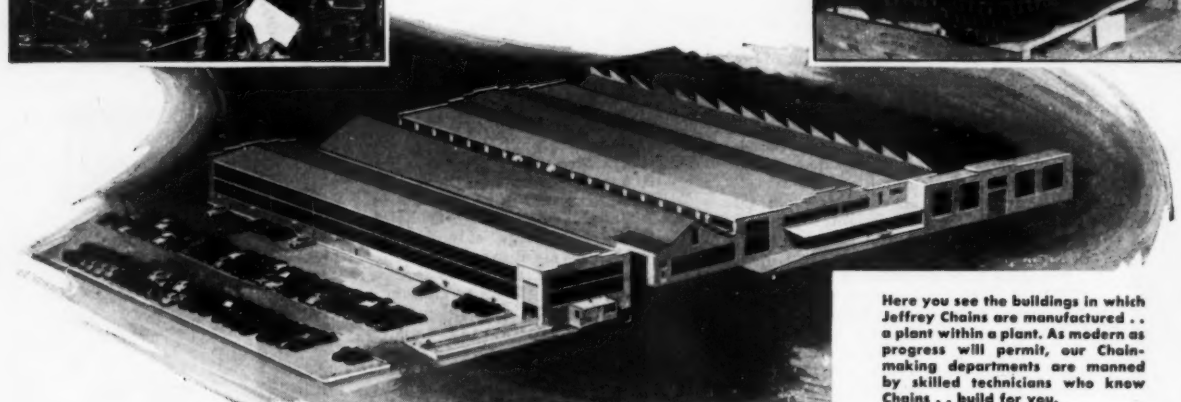
NEED CHAINS? We can ship immediately from our large stock here at home or you can contact any one of our authorized Stock-carrying Distributors, strategically located throughout the United States to better serve your needs.

Our recently-enlarged Chain-making establishment (see photo below) is fully equipped with new high-speed tools . . every modern facility to make chains scientifically better . . faster.

A large assortment of Sprockets, Gears, Pulleys, Babbitted Bearings and other Transmission items are also available for prompt shipment, as well as a line of Spiral Flights, Belt Idlers, etc.

We will be glad to take care of your requirements . . will handle those "Ship At Once" requests promptly. May we hear from you?





Here you see the buildings in which Jeffrey Chains are manufactured . . a plant within a plant. As modern as progress will permit, our Chain-making departments are manned by skilled technicians who know Chains . . build for you.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

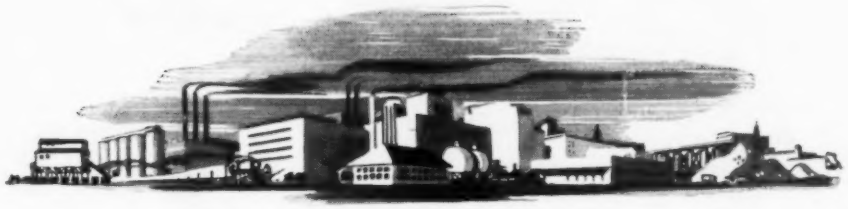
814 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2 · Birmingham 3 · Boston 16 · Buffalo 2 · Chicago 1 · Cincinnati 2 · Cleveland 13 · Denver 2 · Detroit 13 · Harlan · Houston 2 · Huntington 19 · Jacksonville 2 · Milwaukee 2 · New York 7 · Philadelphia 3 · Pittsburgh 22 · St. Louis 1 · Salt Lake City 1 · Scranton 3

Jeffrey Mfg. Co., Ltd., Head Office & Works: Montreal

How to spend $391.25 once and *Save $2160 Every Year!*



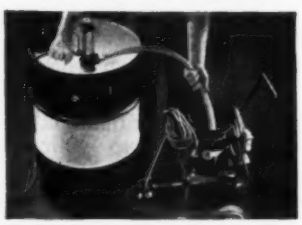
This is the actual experience of a Harrisburg Pa. firm* that stopped the kind of profit loss which may be hidden in YOUR plant, too!

In a material handling survey, lubricating of machines came in for its share of attention. The head of production called in an Alemite Lubrication Engineer to help him spot possible ways to cut costs. They found a way to lubricate machines that added 30 minutes more production daily. The total investment in Alemite equipment was $391.25! The saving in production time—in addition to a 60% reduction in lubricant used—comes to $2160 a year!

*Name on request

No matter what size or type of plant you operate, Alemite can show you dozens of examples of amazing savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. Contact your local Alemite Industrial Distributor now. Or send for free booklet, "11 Ways to Cut Production Costs." Simply attach coupon below to your letterhead. Alemite, Dept. A-00, 1850 Diversey Parkway, Chicago 14, Ill.

Alemite Cuts Costs 3 Ways



1. ***In Transferring Lubricants...*** by eliminating mess, expensive contamination—and cutting man hours 63% for every 100 pounds of lubricant transferred.

2. ***In Loading Grease Guns . . .*** by saving 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.

3. ***In Applying Lubricants . . .*** by saving up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

ALEMITE

MEANS EVERYTHING FOR LUBRICATION

1. Methods 2. Lubricants 3. Equipment

Another Product of Stewart-Warner

FREE! New Booklet—

"11 Ways to Cut Production Costs"...

(simply attach to your letterhead)

Alemite, Dept. M-90
1850 Diversey Parkway, Chicago 14, Ill.

Please send me without charge or obligation your booklet "11 Ways to Cut Production Costs."

Name _____

Company _____

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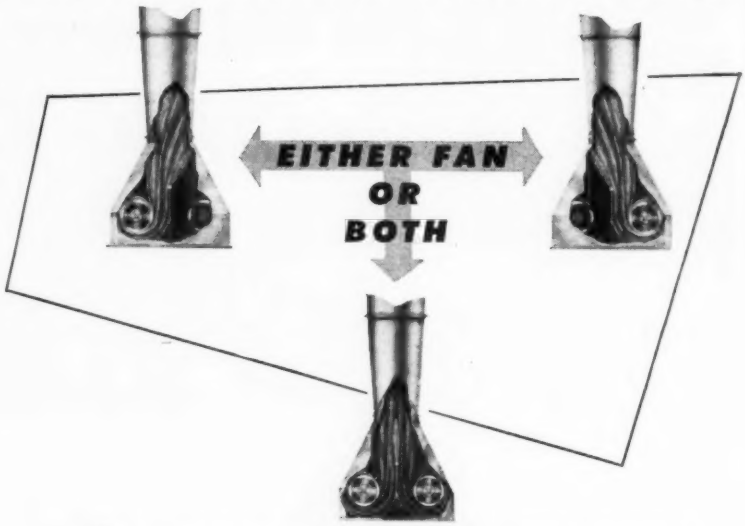
Parallel Operation

with a BACKGROUND of OVER 30 YEARS



As shown in the illustration, either of two fans may be used and will generally carry approximately 70% of the normal load. The second fan can be arranged to start automatically when maximum capacity of the first fan has been reached.

Thus, a basic lower operation cost is realized and this safety factor assures continuous performance in the event of bearing or drive failure. In such an emergency, the boiler can be operated at 70% of normal load instead of a complete shut down, an important factor in large installations. Two boilers, operating from a Single, Twin Fan Stack can be arranged to operate either boiler from either fan.

Our project engineers have a background in fan-stack applications. Consult them for the answer to your draft problems.

Project and Sales Engineers

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GREENWICH, CONN.

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PRAT-DANIEL CORPORATION

69-9 WATER STREET — EAST PORT CHESTER, CONN.

DESIGNERS AND MANUFACTURERS OF POWER PLANT EQUIPMENT

JUST SITS- AND SAVES $2630.00 A YEAR

Pickering Lumber Corp., of Standard, California, writes about G-E CAPACITORS:

"We installed a 420-kvar bank of G-E Pyranol capacitors in 1939, at a cost of $4400. They raised our power factor from 72 to 96 per cent and enabled us to avoid the penalty clause for operating below 80 per cent. In fact, we became eligible for a bonus. We find this installation has made an average *annual* saving in our power bill of $2630 43. Since 1939, this has amounted to $28,930!"

AND EVEN THAT IS NOT THE WHOLE STORY. In 1939, Pickering's connected load was 3400 horsepower—and the power system was fully loaded. Yet by installing an additional 400 kvar of capacitors in 1946, they were able to *add* 2100 horsepower of connected load.

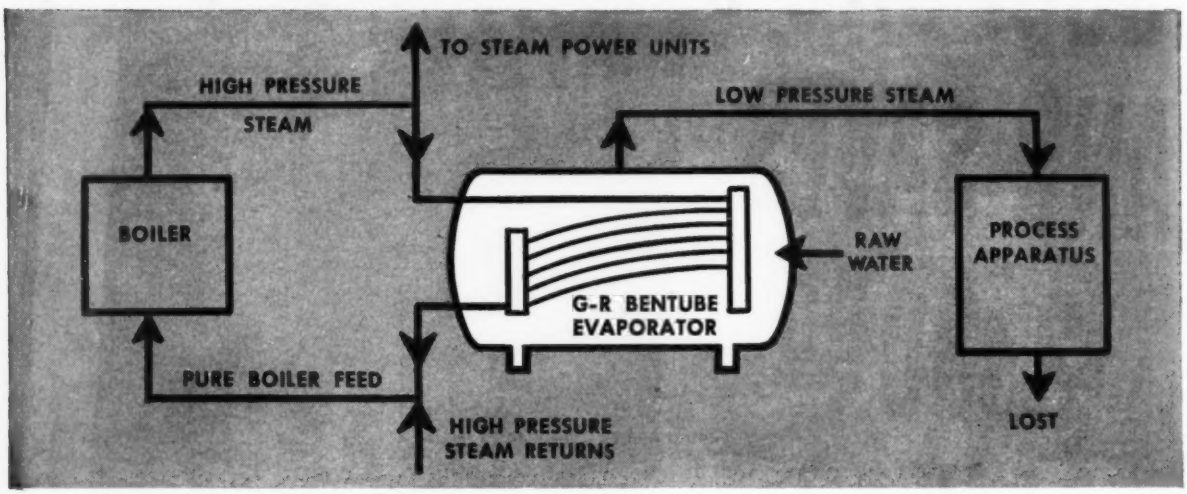
AN EXCEPTIONAL CASE? Probably—but almost every capacitor installation *seems* exceptional. Check the savings you can make! Write for GEA-5167, "A Way to Cut Power Cost That's Too Good to Miss." Address Apparatus Department, General Electric Co., Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

407-194

HOW you can obtain PROCESS STEAM efficiently.



Bulletin 366 explains the various methods of associating evaporators with the plant heat balance and describes in detail the designs and special features of G-R Evaporators. Write for your copy.

A G-R Bentube Evaporator uses steam from high pressure sources to produce lower pressure steam for process work. The high pressure steam which operates the evaporator is all returned to the boiler, after use, in the form of condensate. Therefore, no raw, scale-forming make-up or contaminated drains from steam used in process is fed to the boiler, thus reducing boiler maintenance.

Raw untreated water can be fed to the evaporator producing the process steam. G-R Bentube elements of scale-shedding design make possible the use of raw water because they maintain rated heat transfer without requiring hand scaling.

The G-R Bentube Evaporator used in this service operates as a practically 100% thermally efficient reducing valve, and ideal plant heat balance can be arranged.

Many millions of pounds per hour of process steam are now being produced in highly successful G-R Bentube Reducing Valve Evaporator plants. Investigate this economical method of obtaining process steam for your plant.

THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

GR-196

GRISCOM-RUSSELL

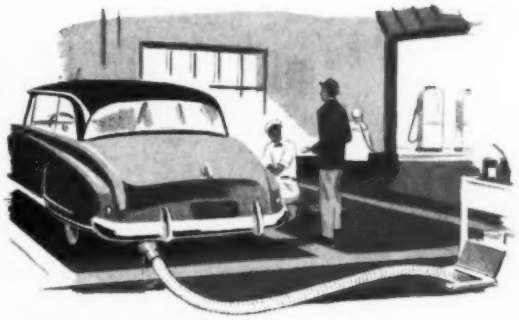
Pioneers in Heat Transfer Apparatus

Variety

is the spice of an American flexible connector's life!

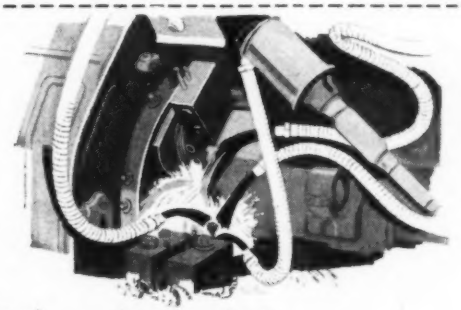
Baker's baby

Believe it or not, this machine forms rolls out of dough. Yep, it's a Readco Vacuum Roll Divider and Rounder. In goes the dough—out come the rolls, ready to bake. American Seamless Flexible Bronze Tubing carries the vacuum—which shows that this famous tubing is equally good for carrying "nothing."



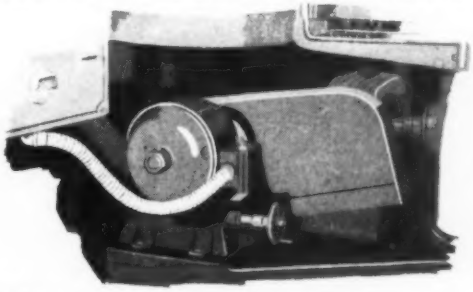
Deadly "CO" has to go

Yes, deadly carbon monoxide is carried off safely by this "Monoxivent" exhaust system, built by the Kent-Moore Organization, Inc. American VAC Type Flexible Stainless Steel Tubing, dependably tight and resistant to rust, heat and corrosion, handily connects the car exhaust to the underfloor duct.



Metal-working robot

With uncanny precision and "intelligence" this automatic lathe installed at The Black & Decker Mfg. Co. puts the bite on metal rod while this American Flexible Coolant Line carries oil to the tool edge. To remove damaging particles of metals, the cutting oils and coolants are clarified by a DeLaval Purifier.



This machine can can

Anyway, it can can as long as the motor can. In use at The California Packing Corporation, it's a disc feeder which automatically feeds cans into a fruit canning production line. The motor feed wires are safely tucked away in American Sealtite* Conduit which protects the wires while providing flexibility for belt take-up.

*Trade Mark

THERE'S a type of American Flexible Metal Hose or Tubing for conveying liquids, many chemicals, gases and semisolids under severe conditions of temperature, pressure and frequent movement . . . for protecting wiring and flexible drive shafts . . . for absorbing vibration . . . for connecting misaligned piping and ports. Let us tell you about them in full detail. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.

50249

wherever connectors must move

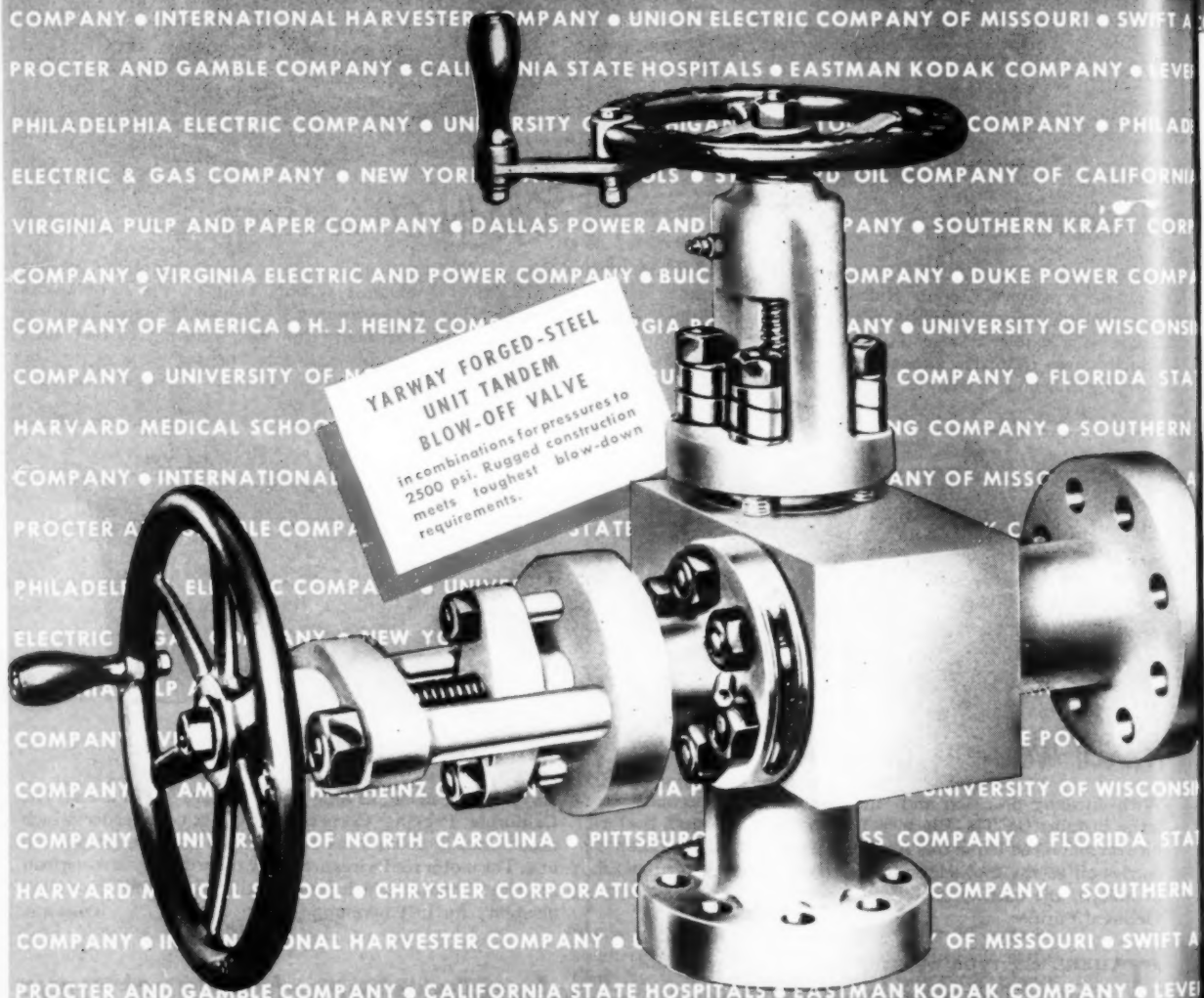
ANACONDA
from mine to consumer

American

FLEXIBLE METAL HOSE AND TUBING

A BLOW-O

IS KNOWN BY THE


YARWAY FORGED-STEEL
UNIT TANDEM
BLOW-OFF VALVE
in combinations for pressures to 2500 psi. Rugged construction meets toughest blow-down requirements.

YARWAY

-OFF VALVE

BOILERS IT PROTECTS

When buying blow-off valves, weigh the significance of these two facts:

More than 15,000 boiler plants in the United States and other countries are equipped with Yarway Blow-Off Valves . . . Some of them for nearly 40 years. *Among high pressure plants, 4 out of every 5 in the United States are Yarway-equipped.*

Design, metallurgy, workmanship and service are the reasons. It was Yarway that brought out the famous Seatless Valve, teamed it with a stellited hard-seat valve in a common forged-steel body to make the popular Unit Tandem. Yarway has also made available metallurgical improvements to withstand the chemical reactions of acid wash as well as the mechanical wear of boiler blow-down.

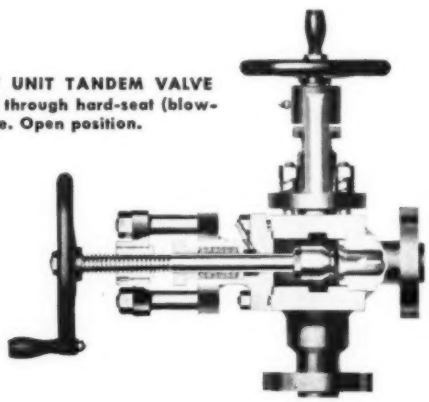
Yarway continues to pioneer and improve blow-off valves and blow-off valve service for both high and low pressure applications.

On new boilers, replacements or modernization, make sure you specify Yarway Blow-Off Valves. Any boiler manufacturer will supply them on your specification.

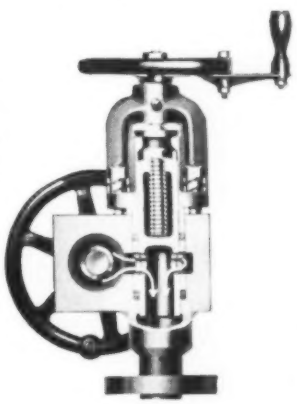
Bulletin B-424 gives you the full story on pressures to 400 psi. Bulletin B-433 for higher pressures. Both are free. Write . . .

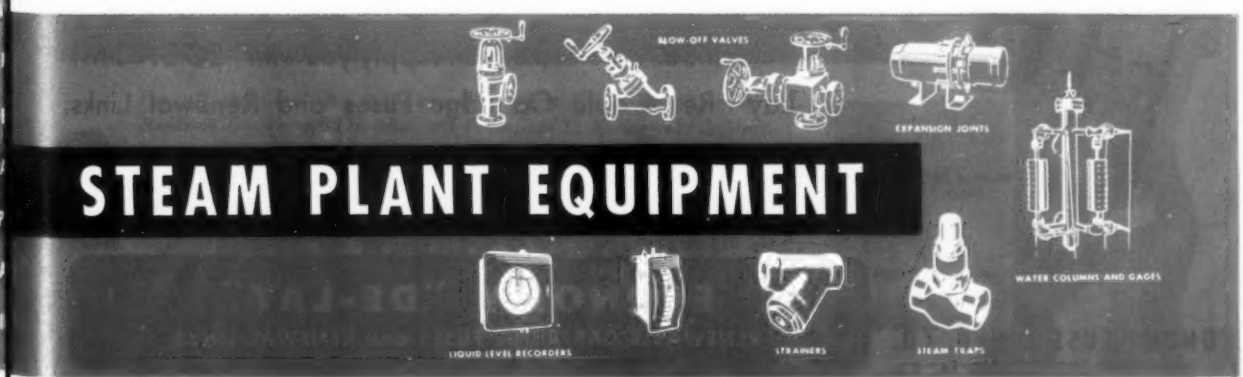
YARNALL-WARING COMPANY, 109 Mermaid Ave., Philadelphia 18, Pa.

YARWAY UNIT TANDEM VALVE sectioned through hard-seat (blowing) valve. Open position.

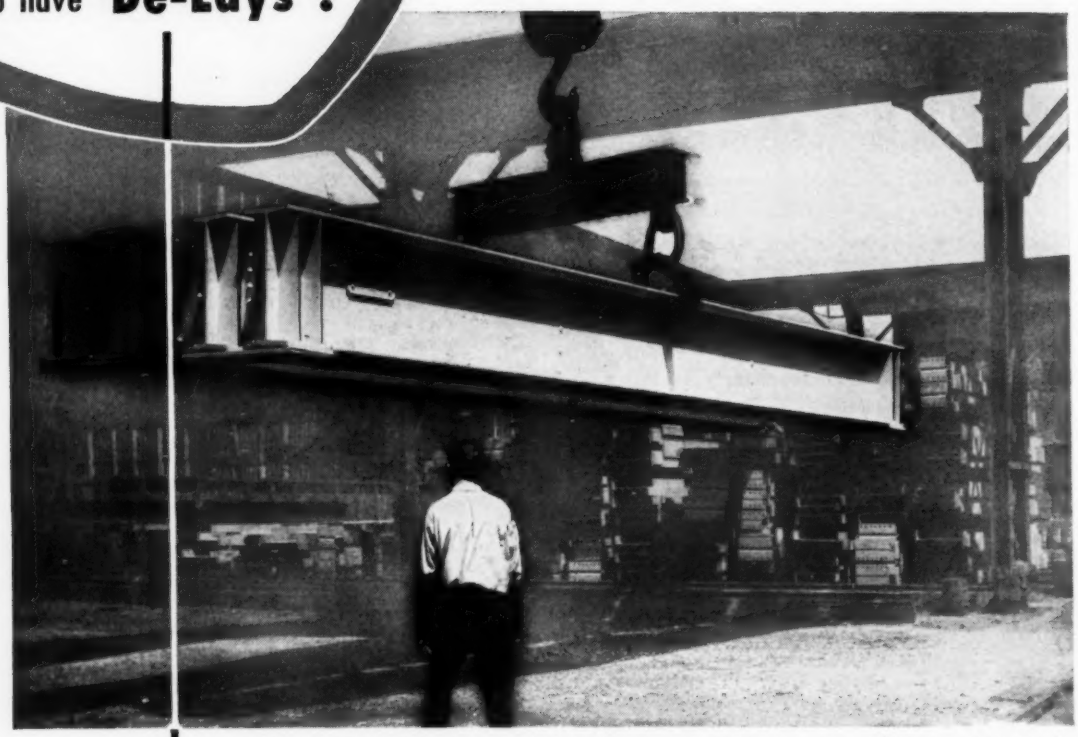


YARWAY UNIT TANDEM VALVE sectioned through seatless (sealing) valve. Open position.





It **PAYS** to have **"De-Lays"!**



Use "Economy De-Lay" Renewable Cartridge Fuses and Economy Renewal Links, and big loads like this will not be "hanging in the air" because of ***unnecessary*** "blows" in the circuits.

"De-Lays" that speed production

Modern "ECONOMY DeLay" Fuses

For Delays that pay, use "Economy De-Lay" Renewable Cartridge Fuses and Renewal Links. They are designed to prevent *unnecessary* "blows" in the 135% and 200% range where most overloads occur.

Your Electrical Wholesaler can supply you with "ECONOMY De-Lay" Renewable Cartridge Fuses and Renewal Links.

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ECONOMY "DE-LAY"
RENEWABLE CARTRIDGE FUSES and RENEWAL LINKS

ECONOMY FUSE & MFG. CO.
2717 GREENVIEW AVE. CHICAGO 14, ILL.

WHERE YOU SEE *this*...
YOU SEE

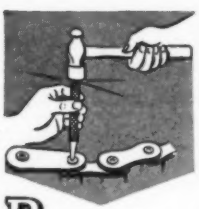
Longer Chain Life, Lower Chain Cost, Easy Adjustment, Faster Service!

This distinctive link marks the new "BA" . . . Baldwin Assembly . . . riveted roller chain. And it's the mark of long, low-cost service.

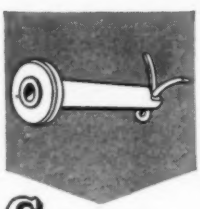
The new "BA" assembly roller chain gives you all the advantages of riveted roller chain . . . longer life . . . even greater ease of field assembly and disassembly than with old style detachable roller chains . . . and in single strand, lower cost.

HERE'S HOW SIMPLE IT IS TO TAKE APART *THIS* ROLLER CHAIN!

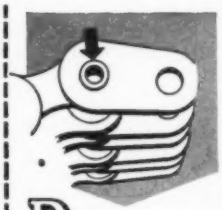
A The single pin connector is the heart of the "BA" assembly and is readily identified by its distinctive shape. One pin in this link has a cotter on one end; the other end is spun over a washer. The other pin is fully riveted to the adjacent link, thus assuring the assembly of the superior life of riveted chain.



B To take the chain apart, simply remove the cotter on the single pin connector link and drive out the pin. Pin is a slip fit through the chain except for a milled flat on the cottered end which is fitted into a special hole in the connector plate. There is no danger of destroying fits or damaging parts with this chain.



C The single pin connector of the "BA" assembly fits snugly into place . . . even though it is a slip fit through virtually the entire link. The washer spun over one end of the pin and the milled flat on the cottered end that is fitted into the special hole in the connector plate, plus the cotter, hold the pin firmly in place.



D An important advantage to you is the fact that the other end of the single pin connector link is firmly riveted to the adjacent link. When the single pin connector is removed, this riveted pin holds the chain parts together, thus keeping plates in line and preventing them from falling out, simplifying assembly.

For all the facts on "BA" assembly, write Chain Belt Company, Baldwin-Duckworth Division, 388 Plainfield St. Springfield 2, Mass., and ask for Bulletin 50-6.

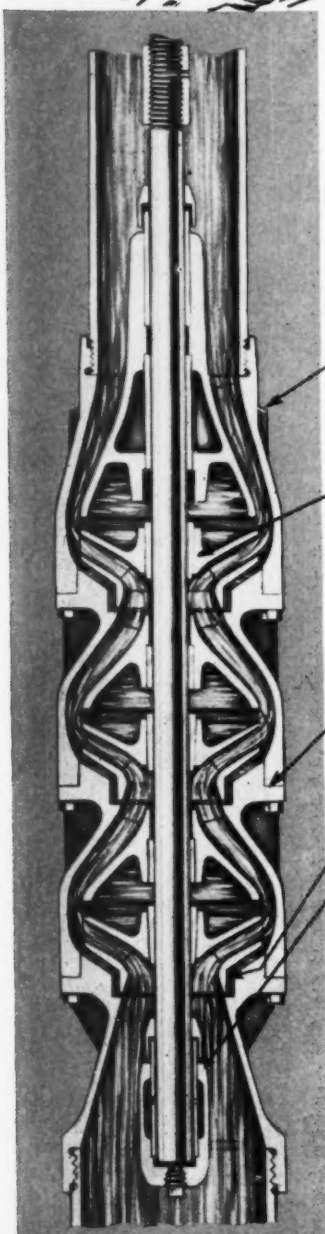
BALDWIN·REX
ROLLER CHAINS

a complete line from ¼-inch to 2½-inch pitch

RE-DESIGNED...for a new high in Pumping Performance!

Worthington Type Q Vertical Turbine Pumps Climax Many Years of Continuous Development

Only the longest and broadest experience in the field could produce the Worthington Type Q Vertical Turbine Pump. New and exclusive casting methods, hydraulic and dynamic balanced impellers, and greatly improved bronze bearings are among the many features combining to give you the most efficient pumping performance at lowest possible cost.



Water-lubricated model illustrated

BOWL DESIGN-DETAILS

1. Discharge bowl construction of advanced type, providing most efficient conversion from velocity to pressure as liquid enters column. Oil-lubricated model includes new double-sealed construction for maximum protection.

2. Having made both enclosed and semi-open impellers for many years, Worthington now standardizes on enclosed. Advantages: up to 50% less down thrust . . . lighter loading of the thrust bearing and less shaft elongation, reducing sensitivity to changes in vertical clearance . . . elimination of extremely close vertical adjustment in the field.

3. Flanged type bowls for tighter joints, less corrosion, easier assembly, better alignment.

4. Renewable bronze wearing rings standard on all sizes except 6″.

5. Large diameter shafts and extra long bronze bearings with sand collars at both ends of bowl assembly maintain rotor alignment, prevent vibration, assure longer life.

Available in sizes from 6″ to 32″, water- or oil-lubricated, Worthington Type Q Vertical Turbine Pumps handle liquids at temperatures of 7° below zero F to 500° F *with maximum head per stage over the entire size range.*

Contact your local Worthington dealer for the whole story that proves *there's more worth in Worthington.* Complete manufacturing and servicing facilities at Denver, Colo., and Harrison, N. J. *Worthington Pump and Machinery Corporation, Harrison, N. J.; Denver 16, Colorado.*

WORTHINGTON

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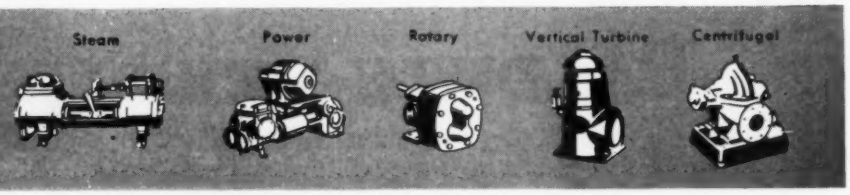
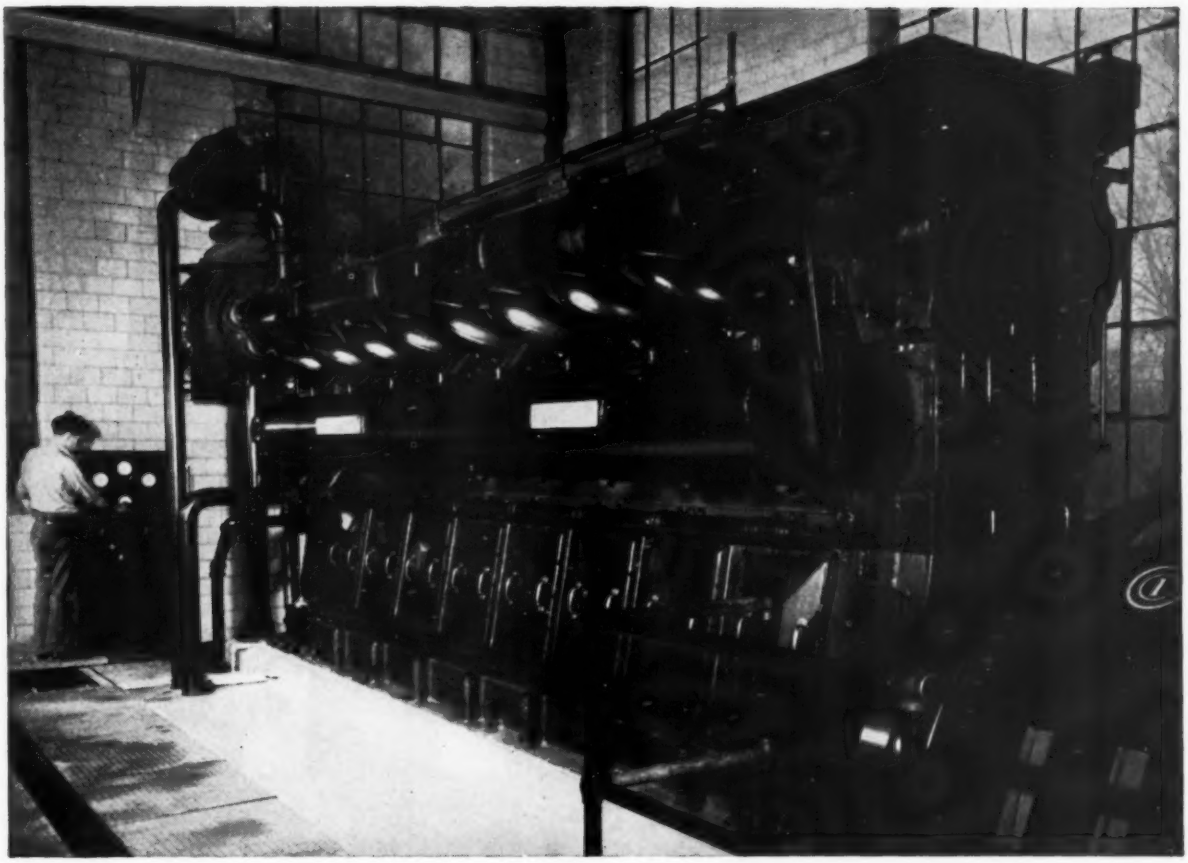
THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB





FROM RED TO BLACK IN A HURRY

● Soaring costs and rising peak demands caused an Ohio generating plant to operate in the red. The management decided to do something about it—and they did.

They looked over the engine field . . . bought a supercharged Superior Diesel . . . and put it to work. After installation, over-all plant capacity was stepped-up almost 17% per gallon of fuel oil. This Model 80 Superior Engine also produced more BHP per gallon of lube oil . . . more than doubling the economy experienced in previous operations. The profit and loss statement changed from red to over $34,000 in the black in just ten months.

If you are looking for ways to cut power costs, chances are that a Superior representative can supply the answer. Why not have him explain how Superior pushes operating costs down? Or, if you prefer, write for our fully illustrated, 20-page booklet.

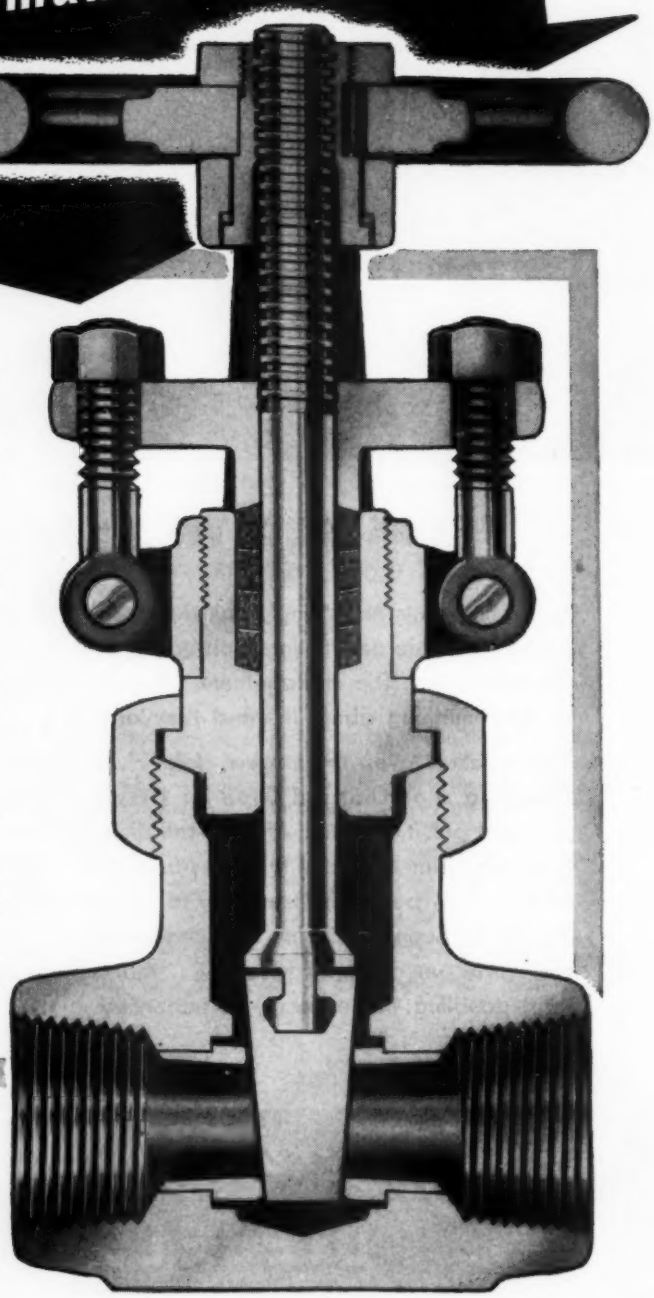
THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

Here's Why You Get Lower Maintenance Costs with Chapman List 960



1. *Gaskets!*
Available with either metal to metal or gasketed joint as required.

2. *50% Stronger!*
New design features compensate at points where excessive strain can develop . . . make stem and wedge gate connection 50% stronger than before.

3. *Wear-Resisting Wedge Faces!*
To keep your maintenance cost down the wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

4. *Replaceable Seat Rings!*
When necessary, you can replace the seat rings easily . . . fast. Seat rings have wear-resisting and non-galling properties . . . made extra hard for years more service.

5. *Full Pressure Repacking!*
No need for costly interruption of flow to repack.

But check this lower maintenance cost for yourself. Next time you buy specify List 960 in sizes from ¼" to 2". Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

The CHAPMAN Valve Manufacturing Company

INDIAN ORCHARD • MASSACHUSETTS

Small HEACON DAMPER Applications that Pay for Themselves...

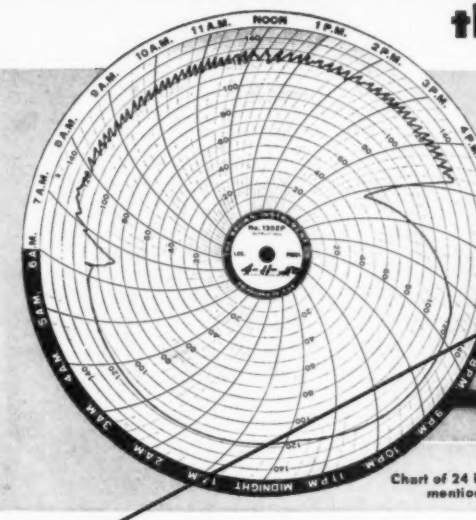


Chart of 24 hour operation mentioned in text

Main Plant of the Passyunk Laundry Philadelphia, Penna.

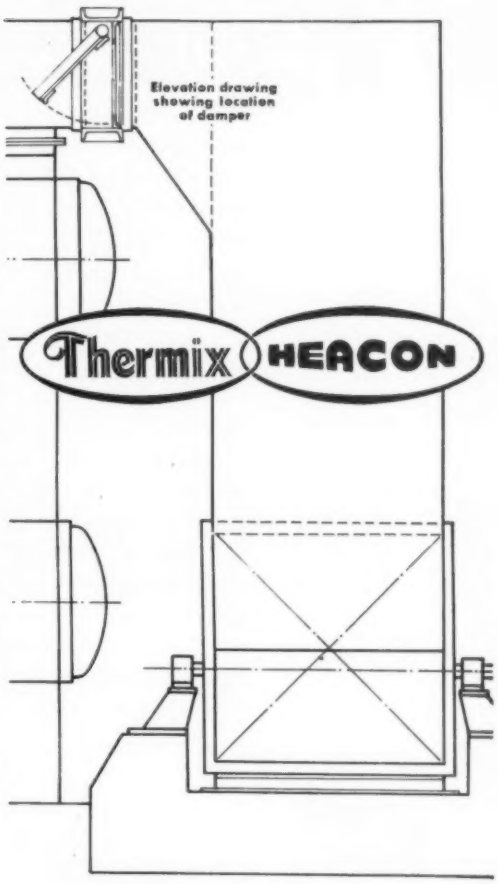
...IN FUEL SAVINGS
...IN REDUCING STARTING TIME LAG
...IN ELIMINATING ATTENDANT COSTS

A 200 H. P. Keeler Boiler supplies power for this modern laundry, operating an engine generator set, pressing machines, ironers and a hot water generator. A Heacon Type L H Damper, located in the duct connecting the outlet of the boiler to a P-D Fan Stack, was installed to maintain pressure during banking periods.

Prior to installation, the boiler was banked at 5:30 P.M., fired to 125 psig at 1:00 A.M. and at 6:30 A.M. available pressure for starting would average 30 psig. Since installation of the Heacon Damper, the oil burners are shut down at 4:45 P.M. and the damper closed. Steam demand is permitted to continue until 5:15 P.M. and the pressure has dropped to 55 psig when the stop valve is closed. This step is necessary to avoid lifting the safety valve. At 7:30 P.M. the residual heat in the setting has raised the pressure to 120 psig and a relief valve opens causing steam to flow to the water heater. This continues until 11:45 P.M. At 6 A.M. when the stop valve is opened, the boiler pressure is 109 psig. This sequence is illustrated by the pressure chart. The fuel saving is obviously considerable. In addition, the cost of a watchman to fire the boiler at 1:00 A.M. is saved and an automatic fire alarm system has reduced insurance rates.

Heacon Dampers are based on an entirely new principle. A Flexible curtain of asbestos conforms to the seals, forming a tight shut-off. This design also permits accurate control, either automatic or manual.

Your critical damper problems, large or small, can be solved by Heacon Dampers, at a cost that will pay for itself in six months. Our engineers will be glad to show you how Heacon Dampers can save you money.



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LOOK what's here!

NOW the popular B&W Integral-Furnace Boiler design available in a cost-saving shop-assembled unit

Now, for the first time . . . all the inherent advantages of "packaged" boilers, *plus* the traditional economies of B&W's Integral-Furnace construction, are combined in a new factory-assembled water-tube unit. It's the B&W Integral-Furnace Boiler, Type FM—delivered fully equipped for immediate operation.

A modern development of the original B&W Integral-Furnace Boiler, this new unit embodies the experience gained through engineering and building over 100 million pounds per hour of installed steam capacity to the same basic design.

Small and medium size plants, institutional and commercial establishments will find in this unit all the answers to low-cost heating and process steam-generating requirements from 3,000 to 35,000 lb. per hr. at pressures to 250 psi. Large plants, too—where space and load characteristics warrant—may profitably consider several packaged boilers as against a "tailor-made" installation.

Coordinated, designed, and built under a single responsibility, this new unit is backed by the same tradition of service-satisfaction that has identified B&W with reliable, low-cost steam generation for more than 80 years.

Send for bulletin G-72, detailing the many advantages of this new B&W creation in low-cost steam generation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

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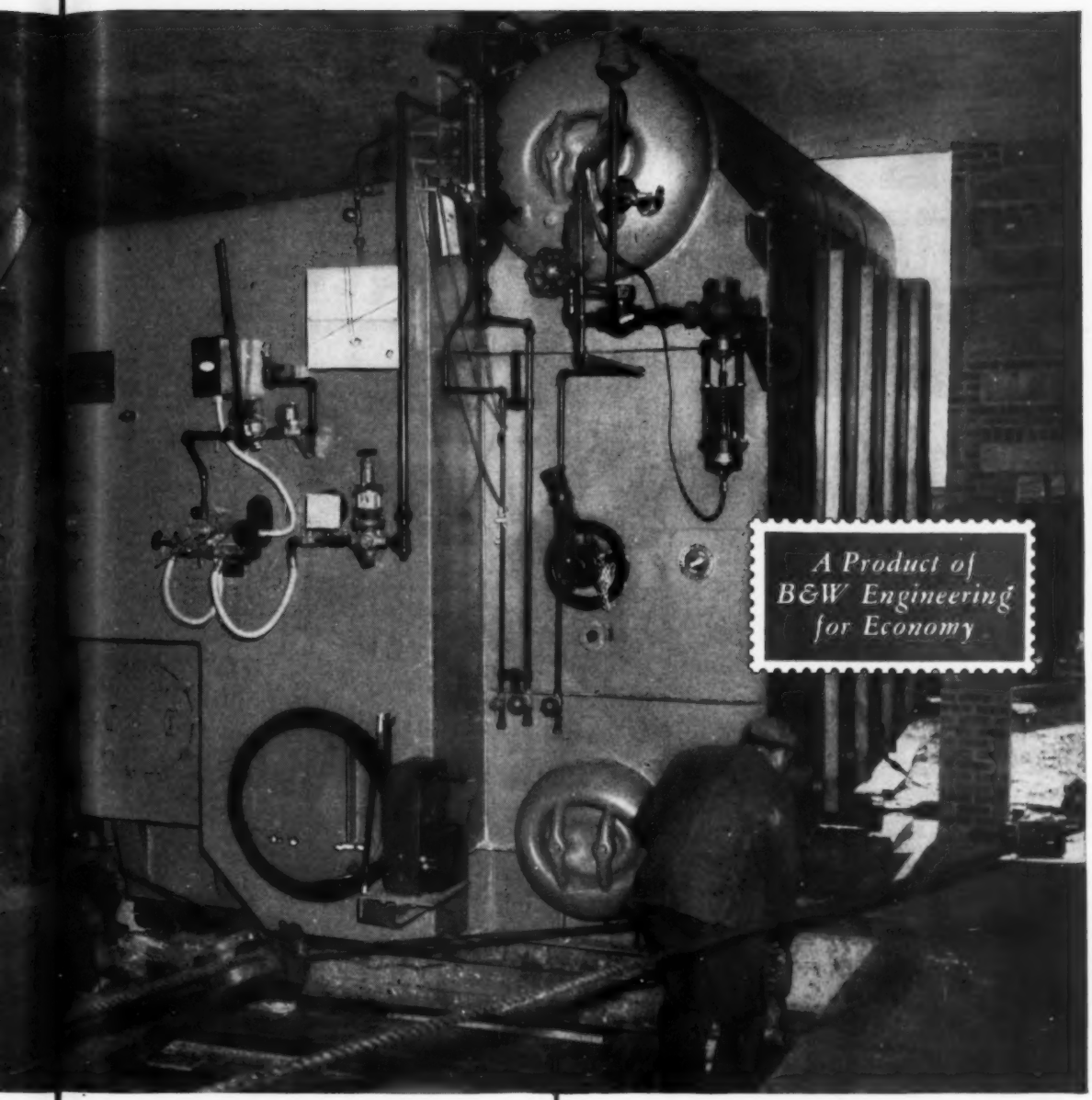

OST-SAVING FEATURES OF THE NEW &W INTEGRAL-FURNACE BOILER, TYPE FM

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

G-4907

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SERIES 12100*

FORGED STEEL

DROP

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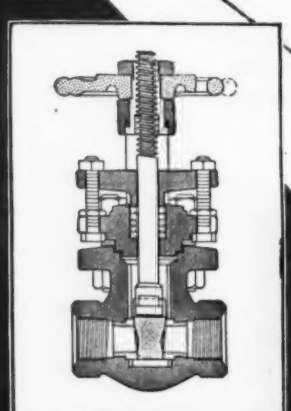
BOLTED BONNET
BOLTED GLAND

150-800 POUND

GATE VALVES

SIZES 1/4" to 2"



*Series 12100

CARBON STEEL } 800 Pounds @ 750°F.
1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes 1/4" to 2" inclusive.

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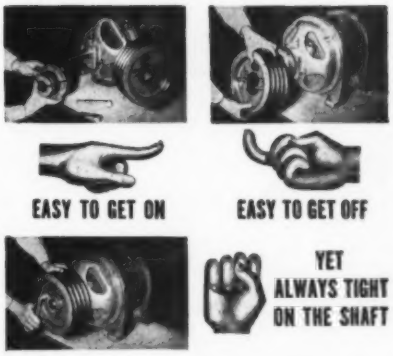
How Does Your Drive Rate on the V-drive Scoreboard?

Here are 15 money-saving features of the most efficient V-belt drive. Only Worthington Multi-V-Drives give you all 15!

These Features Save You Money	For These Reasons	It's a Worthington—
1 Two-piece QD sheave—rim and hub separate	Mount light hub first, then slide heavier rim on tapered hub	EXCLUSIVE
2 Choice of one or two-piece assembly	Mount hub and rim separately, or loosely assemble hub on rim and slide on shaft together	EXCLUSIVE
3 Split hub	Easy to mount, even on oversized shaft	ORIGINAL
4 Clamp screw in hub	Holds hub in position on shaft while setting or removing rim	EXCLUSIVE
5 Taper-mated hub and rim	Mount easily in any position—no keyway between taper surfaces	ORIGINAL
6 Large, long pull-up bolts	Hold better and more uniformly	EXCLUSIVE
7 Friction cone grip	Tightening rim on hub gives positive press fit on shaft	ORIGINAL
8 Shaft key lock (set screw over keyway)	Prevents key from drifting	EXCLUSIVE
9 Quickly-detachable (QD)	Pull-up bolts used as jack screws to remove sheave rim	ORIGINAL
10 Interchangeable rims	Hubs for every bore—lower inventory cost	ORIGINAL
11 No realignment problem	Clamped hub holds shaft position—new rim tightens up in exact alignment	EXCLUSIVE
12 Choice of "A", "B", "C" and "D" grooves	"Tailor-made" grooves give proper belt "ride-out" for maximum life efficiency	ORIGINAL
13 I-beam spokes on driven sheave	Stronger—capable of carrying heavier load with less weight	EXCLUSIVE
14 Offset design of sheave	Reduces over-hang loads—increases bearing life	ORIGINAL
15 Worthington-Goodyear V-belts	Load-carrying cords in neutral axis reduce internal friction—each belt carries its share of drive load	ORIGINAL



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—ORIGINAL TAPERED CONE-GRIP SHEAVE

Complete Range of Stock Sizes—Prompt Shipment. 853 listed stock sizes in "A", "B", "C" and "D" sections, fhp to 600 hp . . . 332 listed stock sizes of EC Cord V-belts. *Send coupon for latest Worthington QD Sheave bulletin.*

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WORTHINGTON PUMP AND MACHINERY CORPORATION
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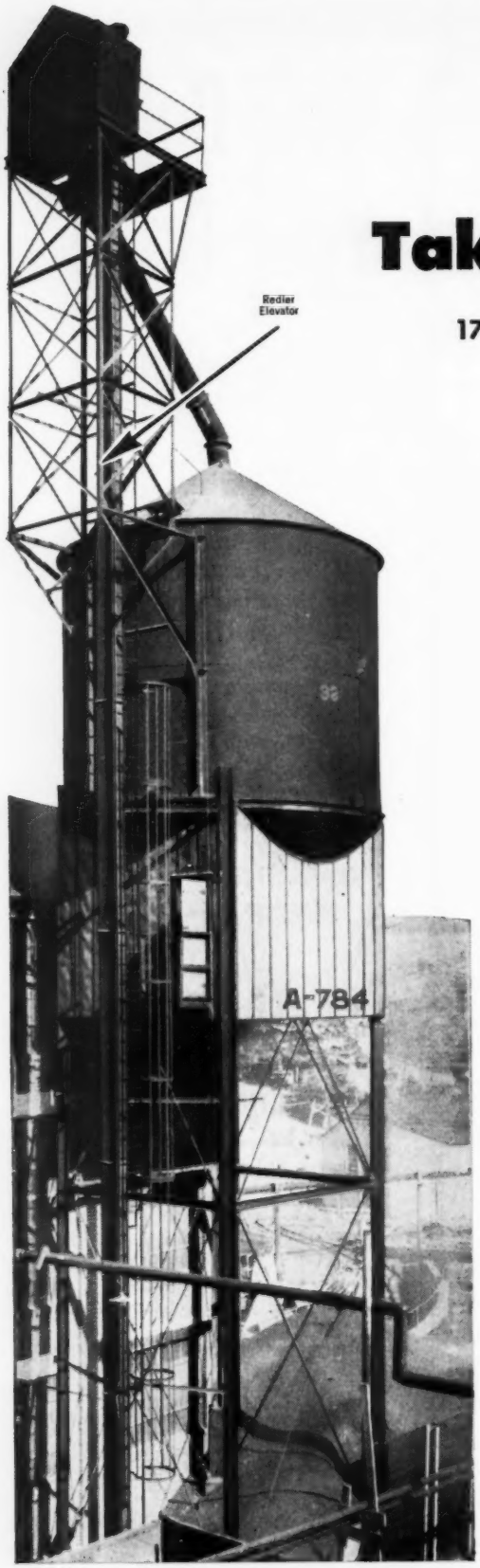


Taking Coal for a Ride

17 FEET HORIZONTAL, 90 FEET VERTICAL IN ONE CONVEYOR

S-A REDLER conveyor-elevator receives coal from cars and elevates it to a high storage bin from which it spouts directly into the boiler house by gravity. No need for a feeder under track hopper.

For nearly half a century S-A engineers have been designing and installing coal and ash handling systems for every kind of industry. From this wealth of experience have come constant improvement both in equipment and methods to give lowest cost bulk handling.

If you are faced with any kind of bulk materials handling problem, Stephens-Adamson engineers will gladly discuss it with you. Their recommendations will not obligate you. Write us today.

STEPHEN S-A DAMSON MFG. CO.

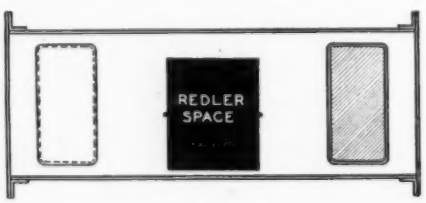
21 Ridgeway Avenue, Aurora, Illinois

Los Angeles, Calif. Belleville, Ontario

ATLAS POWDER COMPANY
WILMINGTON, DELAWARE

A REDLER conveyor-elevator moves coal from under a track hopper and elevates 90 feet to storage. Coal is elevated and stored quickly, in a minimum of space and at the lowest handling cost per ton. Cross section of REDLER casing through which coal moves with chain type conveying element, is only 10 x 12 inches. REDLERS are compact and require a minimum of supporting members yet handle practically any required tonnage. Write us for REDLER catalog 140 for complete details.

At right. Section drawing shows the relative sizes and space requirements of a standard bucket elevator and a REDLER elevator with the same handling capacity.



DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

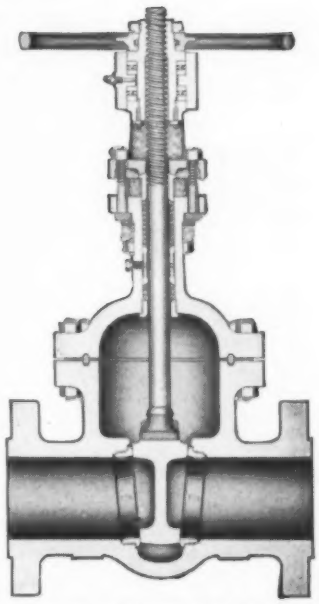
For the best in power piping...
Look to the complete CRANE line

STEEL VALVES FOR GENERAL STEAM SERVICES

You can count on Crane Cast Steel Wedge Gate Valves for dependable performance under the most severe service conditions. Straight-through ports minimize turbulence, erosion and resistance to flow. Long, close-fitting disc guides assure tight seating.

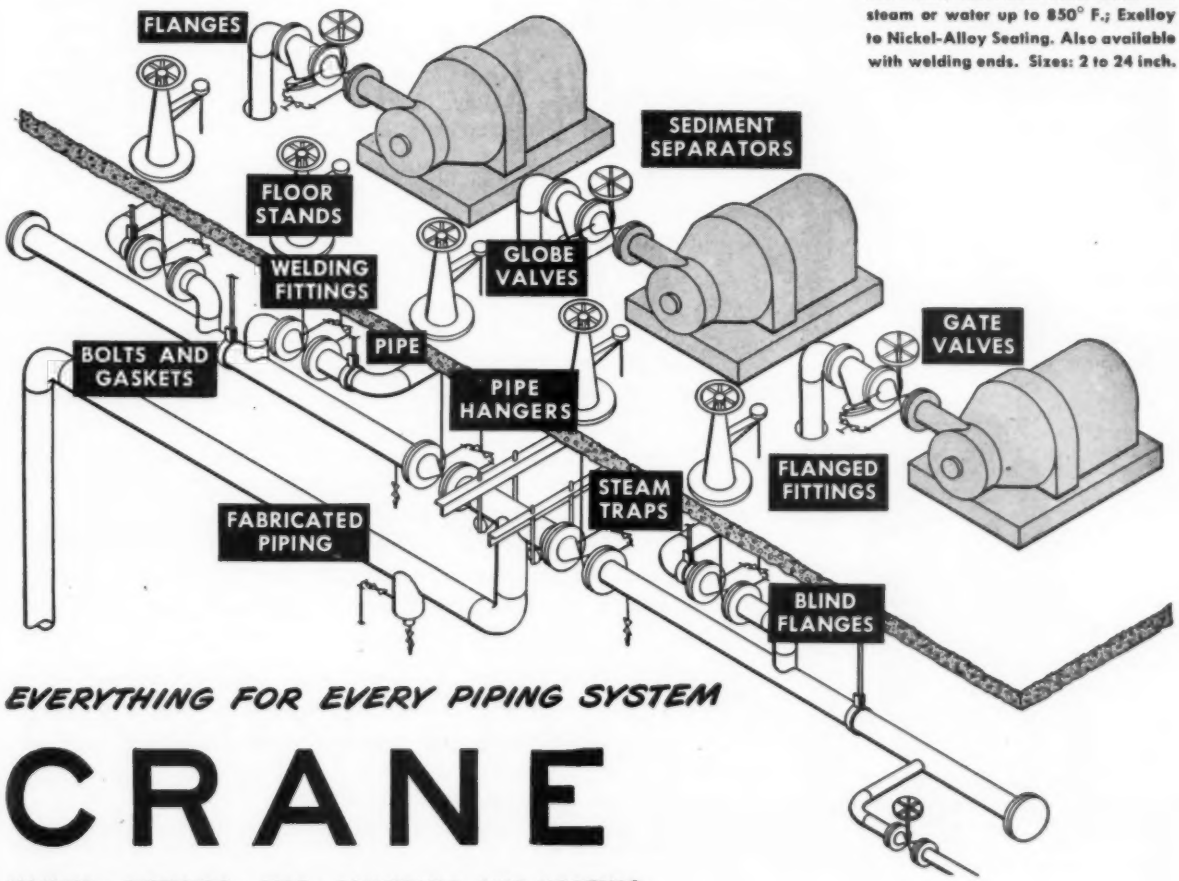
Strong tee-head disc-stem connection, easily lubricated yoke bushing, and ample bearings provide smooth operation. Made of Carbon or Alloy Steel suitably trimmed for pressures and temperatures up to 2500 pounds at 1000°F. Available with flanged, screwed, or welding ends. See your new No. 49 Crane Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



No. 76XR, 600-Pound Steel Gate. For steam or water up to 850° F.; Exalloy to Nickel-Alloy Seating. Also available with welding ends. Sizes: 2 to 24 inch.

THIS STEAM TURBINE PIPING INSTALLATION CAN BE 100% CRANE ON ONE PURCHASE ORDER



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VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

PREST-O-LITE Torches provide a high-temperature flame instantly.

At a flick of the lighter, a full-heat flame is ready for work.

INTENSE HEAT...

ready for instant use

*Prest-O-Lite GAS
Trade-Mark

PREST-O-LITE Torches burn PREST-O-LITE Acetylene from small tanks in two handy sizes: B tank (40 cu. ft.), MC tank (10 cu. ft.) Tanks and refills are readily available from thousands of PREST-O-LITE Gas Exchange Stations throughout the United States and Canada. Return your empty tank to any station, get a full one back, and pay only for the gas.

MC TANK B TANK

A flame temperature as high as 2,800 degrees Fahrenheit—heat to spare for all of your soldering, heating, and light brazing—can be produced by any PREST-O-LITE Torch, using PREST-O-LITE Gas.* Yet complete control of this intense flame is always at your finger tips. A turn of a needle valve gives you the *exact* flame for the job.

Indoors or out, PREST-O-LITE Torches give a clean, full-heat flame the moment you open the valve and light the gas—no pumping, priming, or warmup is ever needed. They're light . . . easy to handle, even in hard-to-get-at places. And there's no waste of fuel between jobs.

Your jobber can show you how to do more jobs better, in less time, with PREST-O-LITE Torches. Ask him to demonstrate the many ways a PREST-O-LITE Torch can save you time and money.

If you don't know your jobber, write us for his name or further information about PREST-O-LITE equipment for soldering, heating, and brazing. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

Order from your local Jobber

The term "Prest-O-Lite" is a trade-mark of The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation.

Reduce Water Bills and Maintenance Costs with the New TRADE LESLIE MARK THERMOSTAT

Specially designed for cooling water service with greatly increased throttling range

It is a recognized fact that water cooled equipment such as air compressors, diesel engines, etc., perform better and require less maintenance if cooling water temperature is accurately maintained. The importance of cooling water control has become accentuated with the growing need for conserving water. The new LESLIE Thermostat and diaphragm Regulating Valve make an ideal Temperature Controller for economic, reliable control of cooling water.

The bi-metallic Thermostat regulates the flow of water (or air) to the diaphragm of the Regulating Valve to maintain a constant water temperature at the bulb location. A slight temperature change repositions the Regulating Valve and regulates the flow of cooling water.

Features of the New LESLIE Thermostat

THROTTLING RANGE—Wide or narrow throttling range can be furnished with adjustable temperature ranges, 32°—400°F and 300°—600°F.

BI-METALLIC ELEMENT—Expansion or contraction of metallic tube provides positive operating force.

SIMPLE—Few moving parts. Simple pilot valve operates without stuffing box or plunger.

RUGGED, RELIABLE—Wear and corrosion-resistant parts give long life. Accuracy of regulation comparable to instrument control.

For small units requiring only ½ or ¾" cooling water supply use the LESLIE Self-Contained Classes MDR, MCR or MBR Temperature Regulators.

LESLIE Thermostat with calibrated dial for easy adjustment

LESLIE Thermostat with 32°-400°F adjustable range

Lowest Overall Cost per Operating Year

Send For— Bulletin 464-B
"Temperature Regulators and Controllers"

50th Anniversary 1900—1950

ESTABLISHED 1900
LESLIE CO.

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory-trained engineers are located.

Albany, N. Y.
Atlanta, Ga.
Baltimore, Md.
Beaumont, Tex.
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Bridgeport, Conn.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Galveston, Tex.
Greensboro, N. C.
Greenville, S. C.
Honolulu, Hawaii
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Monroe, La.
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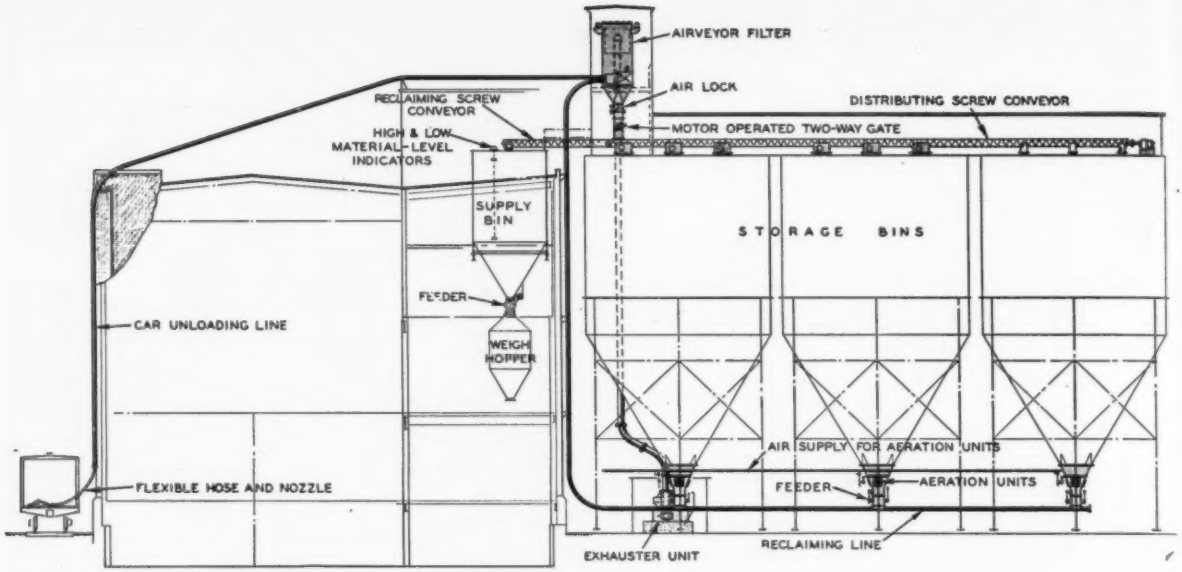
263 Grant Avenue Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES



Conveying clay . . . the better way

The AIRVEYOR®

Many paper mills in the United States and Canada find it good business to use the Airveyor to unload and convey clays.

The above drawing illustrates an Airveyor installed in a paper mill in Pennsylvania. Pulverized coating clay, with a moisture content of not over three percent, is unloaded from box cars (also from hopper-bottom cars if desired) and conveyed to the Airveyor filter, for delivery to any one of three storage bins, or direct to a supply bin above a weigh hopper. Unloading rate, 10 tons an hour. The same system is also used to reclaim the clay from the storage bins and deliver to the supply bin, through remote control from a centrally located panel board. Provision is also made to return, automatically, the clay to the storage bin, from which it is being conveyed, when the supply bin is full; or to any bin when clay is being unloaded from cars.

When you have a conveying problem, why not call in a Fuller engineer. We'll be glad to make a survey, and suggest equipment for the betterment of your conditions. No obligation on your part.

FULLER COMPANY
CATASAUQUA—PENNSYLVANIA
Chicago 3 - 120 So. LaSalle St.
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FULLER

FULLER-KINYON, FULLER-FLUXO, AIRVEYOR, F-H AIRSLIDE CONVEYING SYSTEMS . . . ROTARY FEEDERS AND VALVES . . . ROTARY COMPRESSORS AND VACUUM PUMPS . . . INCLINED-GRATE COOLER . . . DRY PULVERIZED MATERIAL COOLER . . . MATERIAL-LEVEL INDICATOR . . . AERATION UNITS . . . AIRLIFT . . . CONSTANT-HEAD FEEDER . . . SLURRY VALVES . . . MOTION SAFETY SWITCH . . . SAMPLERS

A-101

we'll take the "Red Ink" out of your motor repair shop

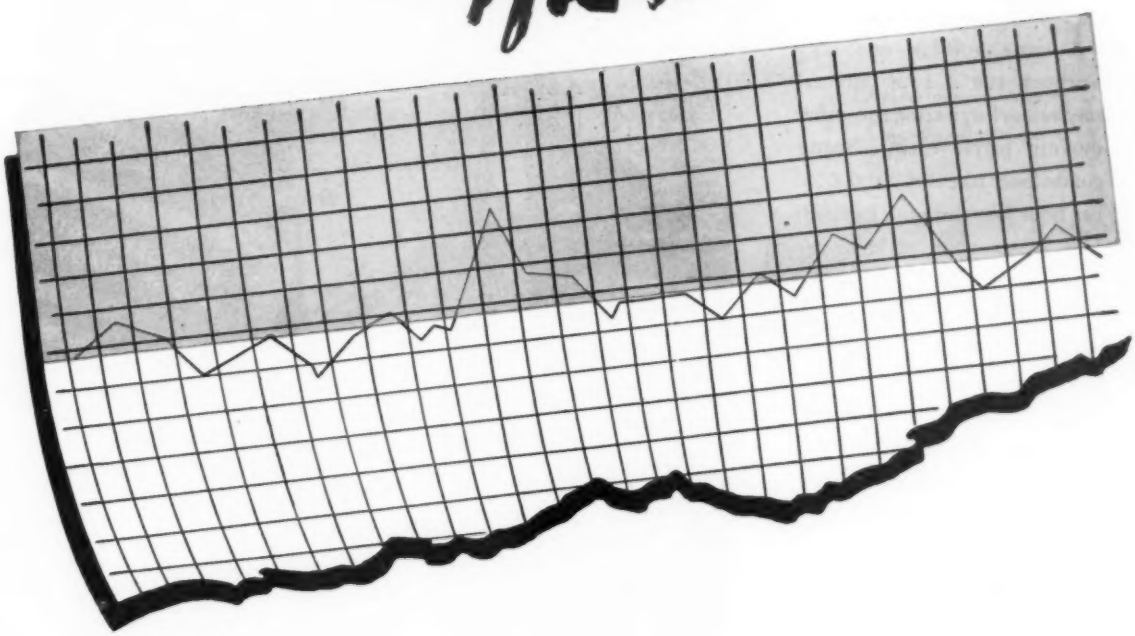


Chart the week-to-week demand and the week-to-week costs of your motor maintenance-repair shop and you'll find that the red ink is concentrated at the periods of peak demand. Normally, the shop probably operates efficiently. But the peak demands cost overtime, and rushed, slighted work. To overcome that condition you'd have to over-equip and over-man your shop. And that means higher cost every day. Many industrialists and generating plants, on the other hand, are operating such shops with very high efficiency. They are equipped and manned to handle the normal demand; they turn over the peaks — the red ink jobs — to us. Thus they avoid the vicious circle of excessive labor costs and excessive overhead. They get work, too, comparable to the best they can do themselves. We've done so much industrial and electrical utility work we know how; we're efficient; our costs are low. That means *your* costs are low, both in your shop and in ours. Our engineers will be glad to come to your office to suggest experienced ways and means of taking the top costs out of *your* motor and generator work. Just drop us a line for quick action.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS, MAKERS OF ELECTRICAL COILS AND INSULATION — REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

No Other Water Conditioning System Has All of These Features...

...ALL IN ONE TANK:

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

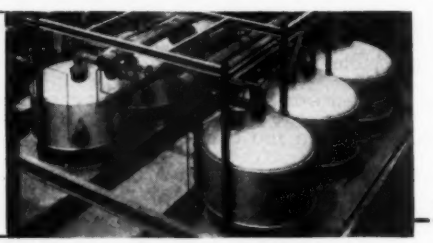
In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N.J.*

Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour

Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System



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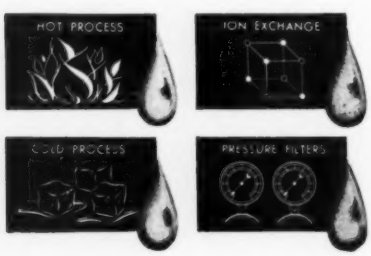


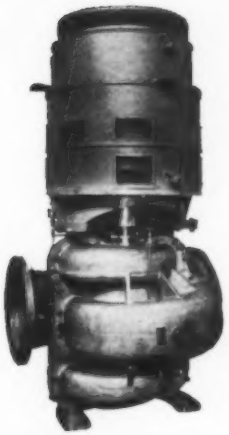
WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment For All Types of Water Conditioning Systems

Longer life in severe service from

MONEL
"K" MONEL
PUMP PARTS



24-inch main condenser circulating pump with a capacity of 15,000 g.p.m. at 25-foot head. Shafts are heat-treated "K" Monel.

Corrosion, erosion, wear, fatigue . . . pump parts must stand up to *all* these destructive forces if satisfactory service is to be achieved.

In particular, where corrosive liquids must be handled . . . salt water, crude oil, chemical solutions . . . the selection of proper materials often spells the difference between weeks and *years* of service.

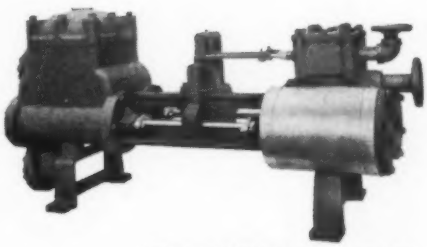
Leading makers and users of pumping equipment have found that pump life can be greatly extended, often tripled and quadrupled, when vulnerable parts are made of *Monel*® or *"K"*® *Monel*.

These two INCO alloys are highly resistant to corrosion by salt water and most commonly-encountered industrial chemicals. In addition, they possess strength and hardness equal to those of structural steel. Both alloys are machinable, and both are available in standard mill forms. Moreover, Monel is readily castable.

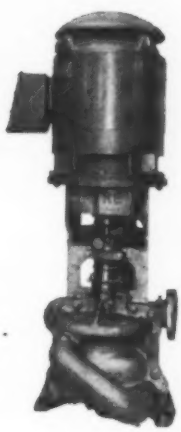
"K" Monel differs from *Monel* in that it may be heat-treated to attain maximum properties, either before or after machining. This feature makes *"K" Monel* an ideal metal for shafts, sleeves, and other highly stressed machine members, while *Monel* is at its best in impellers, valve parts, strainers, and piping.

The International Nickel foundry at Bayonne, N. J., has been casting Monel pump parts for more than 40 years. Among recent technical advances is an improvement in the as-cast surface of sand castings. Shrouded impellers, for example, are now cast with a surface so smooth that pump manufacturers report up to 75 per cent less labor time required for hand filing. The Inco foundry can also supply centrifugal castings for shaft sleeves, cylinder liners and pump rings.

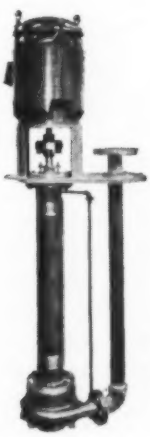
For further information on cast Monel impellers and other Monel pump parts, write to R. F. Johnson of INCO. Ask for your copy of *"How to Get Longer Service from your Pumps."*



Horizontal duplex low-pressure feed pump, 7½ in. by 5 in. by 10 in. Operating pressure is 250 psi. Piston rods and valve rods are Monel.



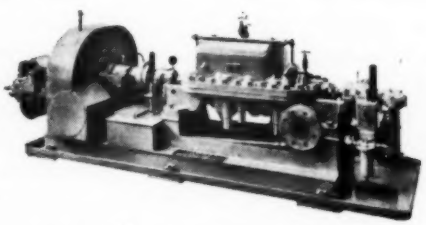
3-inch main condensate pump handling 225 g.p.m. at a head of 180 ft. Impellers are Monel, cast at Inco's Bayonne foundry.



2-inch condensate and drain transfer pumps, handling 100 g.p.m. at a 140-ft. head. Cast Monel impellers were produced by Inco's Bayonne foundry.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

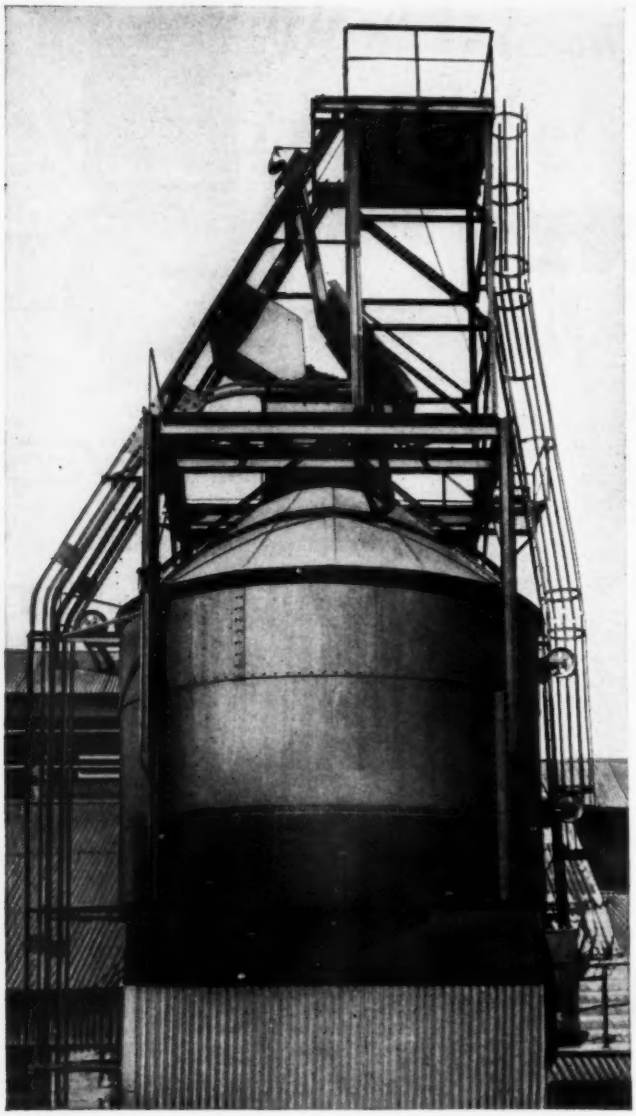
All pumps illustrated were manufactured by: WARREN STEAM PUMP COMPANY, INC. Warren, Mass.



2½-inch, six stage feed pump, driven by a 210 H.P. turbine. Pump delivers 300 g.p.m. of feed water at a discharge pressure of 725 psi, equivalent to a head of 1770 ft. Shaft sleeves are Monel. Impellers are cast Monel, produced by Inco's Bayonne foundry.

EMBLEM OF SERVICE
INCO
TRADE MARK

MONEL . . . for Minimum Maintenance



LOW COST DEPENDABLE COAL HANDLING FOR PUBLIC UTILITIES

Salem Gas and Light Company, Salem, Mass., found a G-W Skip Hoist the ideal solution to the problem of conveying coal and coke to producer storage. The skip bucket keeps the producer-storage bin filled at all times . . . and does the job with maximum economy.

Gifford-Wood Skip Hoists . . . one of many G-W systems of materials handling . . . are low in initial cost . . . low in maintenance . . . long-lived . . . completely dependable. Public utility companies the country over are becoming increasingly interested in Skip Hoist handling of coke, coal and ashes where space is limited and both initial and operating costs must be kept at rock bottom.

This particular installation may not be the perfect solution to your own particular problem. Gifford-Wood, however, has specialized in the design, engineering and installation of all types of materials handling systems for 136 years. To have a Gifford-Wood Materials Handling Engineer survey your present method of moving materials, places you under no obligation and it may well be your first step toward lower operating costs and increased production.

GIFFORD-WOOD CO.

Since 1814
HUDSON, NEW YORK

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When You Think of Materials Handling — Think of Gifford-Wood

NO OTHER TESTER

does so much...so well!

WESTON
Model 785
INDUSTRIAL CIRCUIT TESTER

In the shop . . . 28 ranges *in one case* to locate circuit troubles on production equipment.
On the bench . . . 28 ranges *in one case* for checking electrical equipment during manufacture.
In the lab . . . 28 ranges *in one case* immediately available for research and development work.

28 Instrument Ranges

D-C VOLTS: 100 mv, 1/10/50/200/500/1000 volts (20,000 ohms per volt).
A-C VOLTS: 5/15/30/150/300/750 volts.
D-C CURRENT: 50 microamps; 1/10/100 milliamps; 1/10 amps.
A-C CURRENT: .5/1/5/10 amps.
RESISTANCE: 3000/30,000/300,000 ohms; 3/30 megohms.

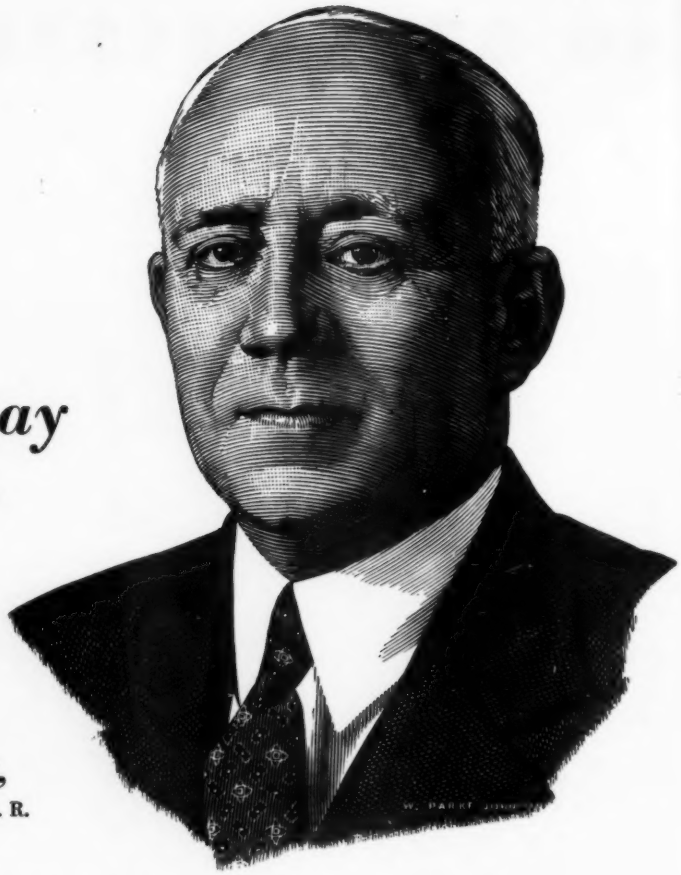
Stock Accessories Available for Extending Above Ranges

It does *so* much, *so* well, for *so* little. Check your Weston Representative for full details or see your local jobber. Weston Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue Instruments.

WESTON *Instruments*

Albany • Atlanta • Boston • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Jacksonville • Knoxville • Little Rock • Los Angeles • Meriden • Minneapolis • Newark • New Orleans New York • Orlando • Philadelphia • Phoenix • Pittsburgh • Rochester • San Francisco • Seattle • St. Louis • Syracuse • Tulsa • Washington, D. C. • In Canada, Northern Electric Company, Ltd., Powerlite Devices, Ltd.

"The easiest way to buy Bonds..."



MR. MARTIN W. CLEMENT,
Chairman of the Board, Pennsylvania R. R.

"The easiest way to buy bonds is through the payroll savings plan. We on the Pennsylvania believe in that plan. Labor and management, officers and employees, over half of us are enjoying it. We believe that it is good for our country, that it is good for our company, and that it is good for ourselves and our families to have these savings."

Top executives of more than 20,000 large companies share Mr. Clement's conviction that the Payroll Savings Plan is good for the country, the company, the employees and their families.

Obviously it is good for the country. The monthly purchase of Savings Bonds by more than 8,000,000 Americans is building a huge fund of buying dollars that will be reflected in the sales curves of tomorrow.

And certainly it is good for the company. The employee who puts a part of his earnings in Savings Bonds *every month* is not the type of man whose name appears frequently on the absentee or accident records. Serious savers are serious—productive workers.

For the employee, the Payroll Savings Plan is a positive boon. It is the easy, automatic way for him to build financial independence, provide for the education of children or save money for a home.

If your company does not have a Payroll Savings Plan, here are two things you can do *today:*

Appoint a Bond Officer, one of your major executives—the kind of man who picks up a ball and runs with it. Tell him to get in touch with the State Director, Savings Bond Division, U. S. Treasury Department. The State Director is ready with a package plan—application cards, promotional material, practical suggestions, and all the personal assistance your Bond Officer may need.

Then make a note on your calendar to check the status of your Payroll Savings Plan six months from today—and you will be surprised and gratified at the high percentage of employee participation you will find.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

INDUSTRY and POWER

The TERRY TURBINE

TURBINES FOR *Air Conditioning* AT MADISON SQUARE GARDEN

In 1925 Madison Square Garden installed three Terry Multi-Stage Turbines to drive air conditioning and refrigeration compressors. These units deliver 290 hp at 3500 rpm with steam conditions of 100 psi exhausting to a 26 in. vacuum.

After 22 years experience Madison Square Garden installed three more Terry Multi-Stage Turbines, one of which is shown above. This unit delivers 330 hp, at 5650 rpm, with steam at 100 psi exhausting to a 25 in. vacuum.

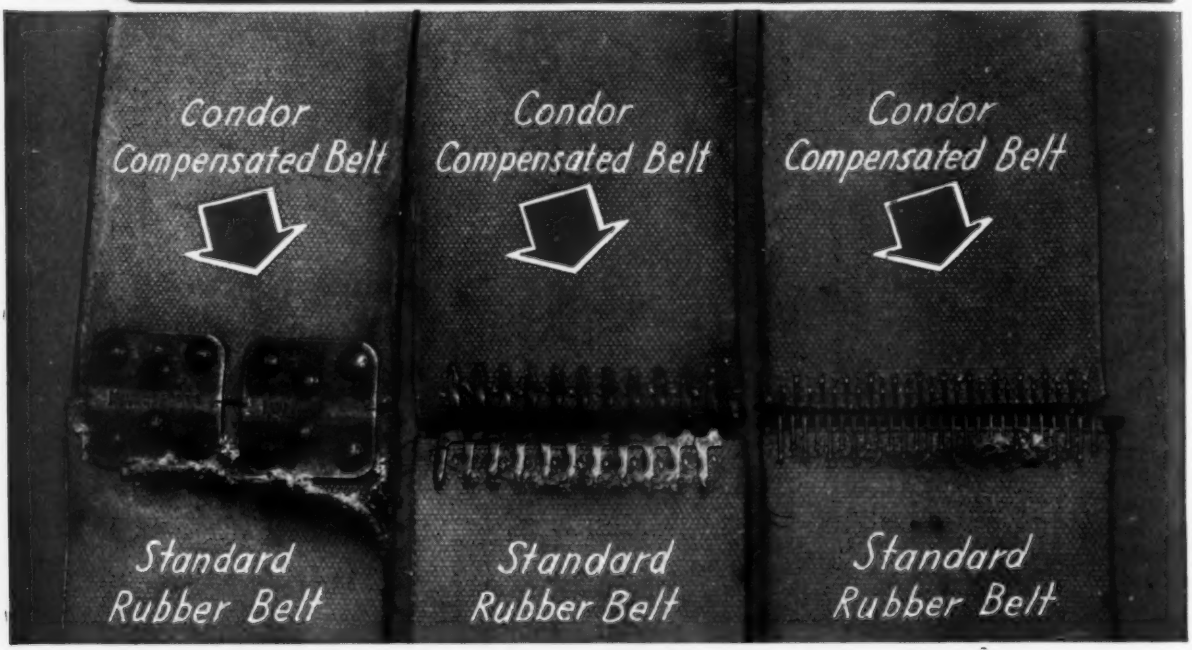
The same engineering talent and manufacturing facilities that produced these turbines are available to assist you in obtaining efficient power generation.

Any of our District Representatives will be pleased to give you full information on a turbine drive for your requirements. No obligation. May we send you descriptive bulletin?

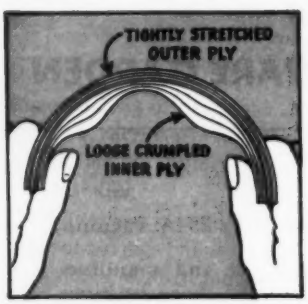
TT 1184

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Here's Why A Condor COMPENSATED BELT lasts 3 to 4 times longer



Compensation Principle Relieves Over-Worked Outer Plies



You can see what happens to the plies of an ordinary transmission belt by holding a pad of paper firmly and bending it as a belt bends around a pulley. All the stress and stretch goes to the outer plies. Outer ply rupture is the cause of most belt failures . . . especially at the fasteners.

The photos shown above are from actual tests under equal operating conditions, where Condor Compensated Belt was tested against high quality, regular transmission belt. In every case, Condor Compensated Belt outlasts other constructions, giving as much as 3 to 4 times longer service at the fasteners.

The Compensation Principle is an exclusive Manhattan feature by which stresses between plies are equalized so that the inner plies share the load equally with the outer plies and the life of the belt is considerably extended. In fact, a Manhattan customer recently reported that a Condor Compensated Belt is in its 18th month of service on a drive that had "killed" previous belts in only 2 to 3 months.

Manhattan Engineers' claims of longer life in Condor Compensated Belt are conservative when measured against actual user reports. Try a Condor Compensated Belt, the belt with Equalized Ply Stresses, and prove to yourself the savings that are possible for the drives in your plant.

FOUR DRIVING SURFACES FOR EXACT MACHINE SELECTION

Condor Compensated Belt is also available with 4 driving surfaces for operating conditions varying from low-tension to a degree of slip, as on winder drives.

Send for Bulletin 6808 H. Your nearest Manhattan Distributor will promptly serve you.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

INDUSTRIAL POWER

September, 1950 Vol. 59, No. 3

Editorial

MEETING A PROBLEM

EARLY EVENTS in Korea were reflected in swift steps toward military and industrial mobilization. It now appears that the war effort's effect on many industries will not be as great as first feared, and that production of military equipment and supplies can, for the most part, be superimposed on current high levels of civilian production.

Industry has already felt and absorbed with comparative ease the first effects of Government speed-up efforts to outfit the expanded military forces. And barring complete mobilization, it is anticipated that industry can absorb additional military production without affecting too greatly required civilian needs. Reason for such anticipation is the unprecedented expansion of American industry during and since the last conflict. Here are some of the facts:

American industry since 1945 has spent over $80 billion on plant expansion programs.

Steel production today exceeds 100 million tons annually compared with 85 million tons in 1941.

Aluminum production today is four times that of 10 years ago.

Automobile production is up 100 percent over the 1939 figure.

Machine tool production, valued around $225 million annually in the late 1930's, today exceeds $600 million and could with far less effort than in 1941 and '42 be expanded to $1,000 million.

The synthetic rubber industry, new since 1940, today has an annual production capacity of over 600,000 tons. With return to production of inactivated plants, this figure would exceed 1 million tons.

Production of electric power has reached an all-time peak: approximately 375 billion kwhr annually.

On the labor front, almost 10 million more persons are employed in U. S. factories than in 1941.

Such increases in industrial capacity, plus current emphasis on conversion to partial war production, have posed new problems for the Plant Engineering Group—those executives and engineers who select, install, operate and maintain equipment used for power, processing and engineered plant services. They are the men behind the production lines—the men who keep plants operating at top efficiency.

Last month we canvassed a number of plants to get a picture of how these men are meeting their problems. Aside from installation of new equipment to increase plant efficiency, here is a summary of the answers:

Renovation of existing steam and electric generating plants, including installation of modern efficient auxiliary equipment.

Complete plant instrumentation for automatic control of operating and processing machinery.

Adoption of material standards to reduce time and waste in selecting and installing proper types of equipment.

Establishment of budgets to reduce operating costs of power-generating and processing units.

Organizational changes to make possible more direct supervision of operating and processing procedures.

Increase in the number of maintenance supervisors, establishment of area responsibility for maintenance, and creation of preventive maintenance programs.

Improved labor efficiency. In one case a plant achieved the same over-all efficiency in 1949 with 25 per cent smaller hourly force than in 1947.

Intensive training of maintenance craftsmen and supervisors combined with unceasing campaigns against minor service wastes.

William J. Hargest

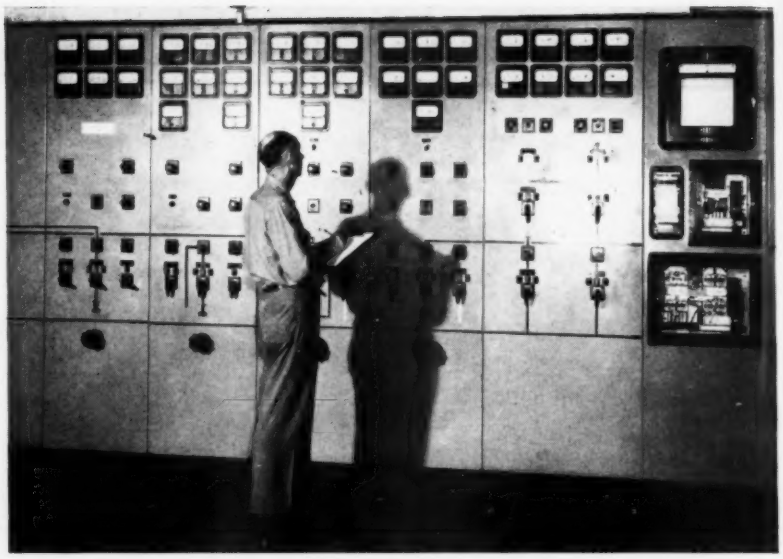


Fig. 1—Generator and main switchboard panel supervises production of power in the four turbo-generators and distributes it to the 13.2-kv main feeder busses

FLEXIBLE NEW POWER

This high-voltage system will supply adequate power for increased operations and shifting loads for many years. New methods simplify layouts and reduce fault currents

AT THE END of World War II, Studebaker's distribution was badly overloaded and well beyond the safe interrupting capacity of the equipment. Furthermore, postwar expansions were contemplated, and it was obviously necessary to take steps to increase the capacity and modernize the system.

In 1945, the chief plant engineer, O. H. Klausmeyer, initiated an investigation into the future needs of the company and started the planning that was culminated in the efficient, flexible system that will serve production for years.

Possibilities in using the old system were thoroughly considered. The company has its own powerhouse containing four generators totaling 20,000 kva. They were wound for 2300 v, three phases and the power was distributed throughout the plant at that voltage. It would have been possible to increase the distribution voltage and still use the old substation transformers and equipment with a 2300-v delta to 4100-v wye transformation. However, the old equipment would still have been overloaded and beyond its safe interrupting capacity, and there would still be considerable copper loss in the long distribution lines serving the widespread building of the plant.

By going to a 13.2 kv system, the savings in power and cable costs would more than offset the salvage value of the old equipment. Furthermore, a complete new system could be installed, and the changeover from the old system made, without interrupting production.

It was decided that the generators would be used with new control-equipment and that an all new, 13.2 kv feeder and substation system would be installed. Having proceeded on this basis, the new system is practically complete and in the final stages of changing over from the old equipment. Distribution is through a radial primary feeder system to 42 load-center unit substations, tied together in pairs on the 480-v secondary side by normally open, emergency tie breakers. The feeder cables are, almost without exception, run underground through new ducts and manholes. The old distribution will be completely abandoned.

Of the four turbo-generators in the powerhouse, the two larger, 6250-kva machines were rewound for 13.2 kv and now supply the feeder system directly. The two smaller 3750-kva machines would have required derating, if rewound, because of the thicker, high voltage insulation. Therefore, one supplies the feeders through transformers, the other is used primarily for the 2300-v house service.

Formerly, all generators were excited from a common bus. In the changeover, the two larger machines were provided with direct connected exciters and the two smaller ones with motor-generator sets. Each exciter is controlled by a Westinghouse voltage regulator responsive to generator output.

In addition to their own power generation, the system is connected to the Indiana & Michigan Electric Co. lines through two 5000 kva, 27.6/13.2 kv transformers in an outdoor substation. Studebaker is one of the few companies to have their own power system continuously connected to utility lines.

Part of the generator control board is shown in Fig. 1. In addition to generator instrumentation, there are meters to indicate the load on feeder busses and on special feeders. The board is located in the wall between the generator room and the feeder switch-gear addition so that short connections are possible.

It was necessary to build a 21 by 117 ft. addition to the power house to accommodate the main feeder switching equipment, partly shown in Fig. 2. Because this available space was limited, and because of the economies in smaller breakers, the interrupting capacity of the new system is limited to 250,000 kva by the novel reactor scheme included in the feeder bus system described below.

Fig. 3 is a schematic diagram of the connections of the feeder bus system which is the main connecting link between the generators, the utility power lines and the distribution feeder lines to the various load centers of the plant. Bus No. 4 is the actual electrical center of the whole system and is connected directly to the 27.6 kv substation handling the power from the I & M lines. The two 6250-kva generators and one of the 3750-kva machines are each connected through breakers to one of the other three main busses which are, in turn, connected to bus No. 4 through 8 percent reactors.

Distribution feeders are divided into three groups, and connected to the three generator busses through their individual breakers, Fig. 2. Note in Fig. 3 that under normal conditions, each generator supplies its group of feeders directly and that the reactor connections to the central bus No. 4 carry only the excess generator output or the extra peak power supplied to that group of feeders. However, in

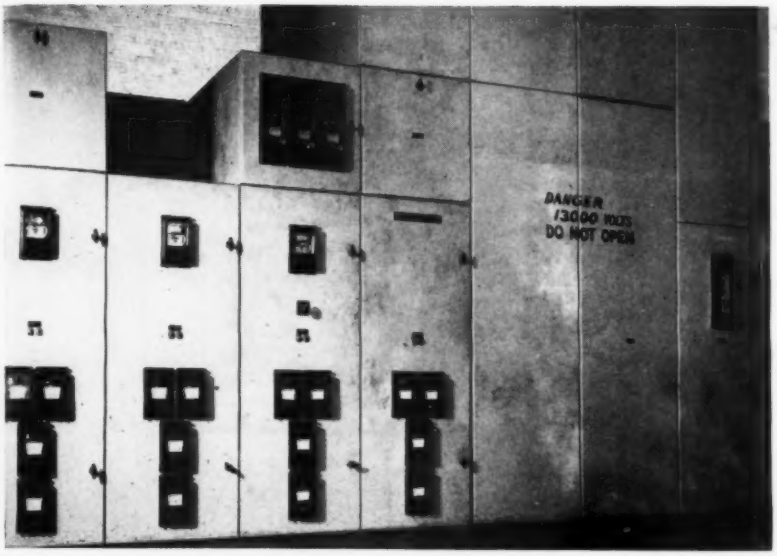


Fig. 2—Oil circuit breakers, power meters, relays and reactor for main feeder bus No. 3 carry the power to one group of feeders for plant-wide distribution

DISTRIBUTION SYSTEM FOR STUDEBAKER

E. G. MOREHOUSE, ***Electrical Distribution Engineer***
The Studebaker Corporation

case of fault, the reactors would limit the short-circuit currents circulating from the other generators and utility lines to the feeder bus on whose lines the fault occurred.

The main drawback of the reactor scheme appears at the time one of the generators is out of service and its group of feeders is supplied power entirely from the other feeder busses through the reactors. Then the reactor drop may be objectionable.

One of the 3750-kva generators, which was not rewound, and which is used to supply power to the system, is connected to bus No. 1 through two, dry-type, 2000-kva, 2.4/13.2-kv transformers in the feeder switchgear addition. The other small generator, used for house service, is connected through reactors, Fig. 3, to the two house service busses. One 2000-kva, dry-type transformer provides stand-by power from main system to house service.

House service switchgear, supplying the feedwater pumps, forced-draft fans, etc., is in a separate room across the generator room from the main switchgear. While the major portion of the load is 2300 v, there are two 2300/440-v, dry type transformers, plus another for lighting.

Feeder lines drop from the main bus switchgear, Fig. 2, into the cable vault below, Fig. 4, and then down to the manholes that start them through the underground duct system, Fig. 5, for distribution to the various buildings of the plant. Fig. 4 shows the typical

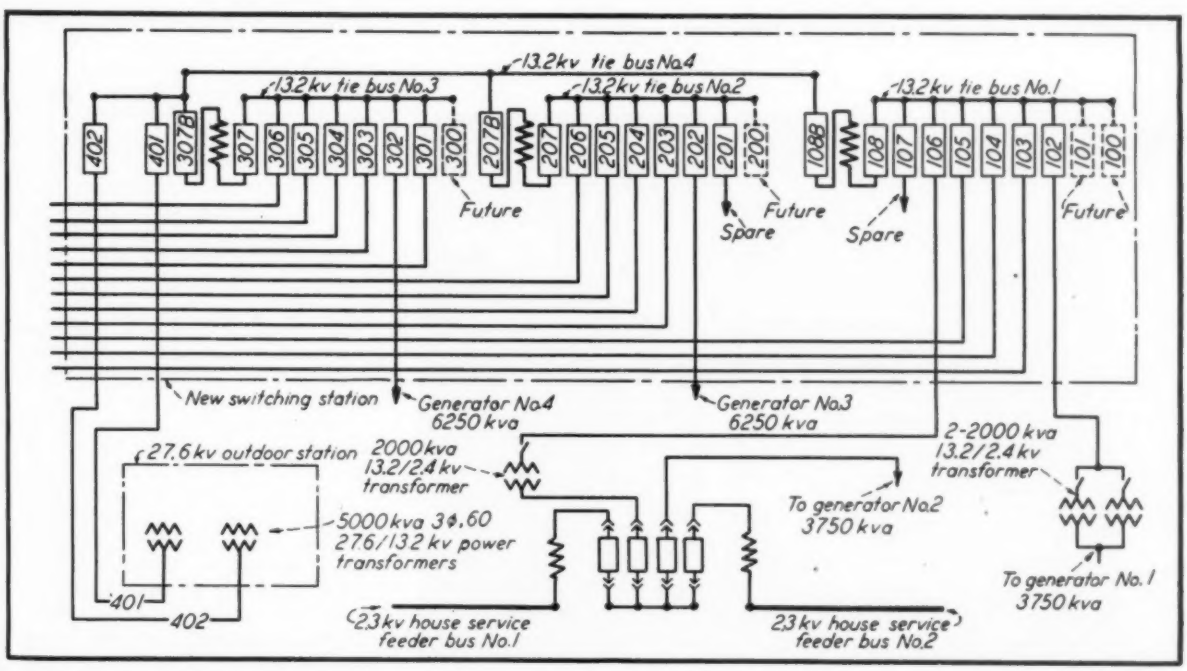


Fig. 3—Bus No. 4 ties together three generator busses and utility lines through reactors. Each generator normally supplies own feeder bus. Reactors carry peaks or excess power, limit fault currents. House service has a similar bus arrangement

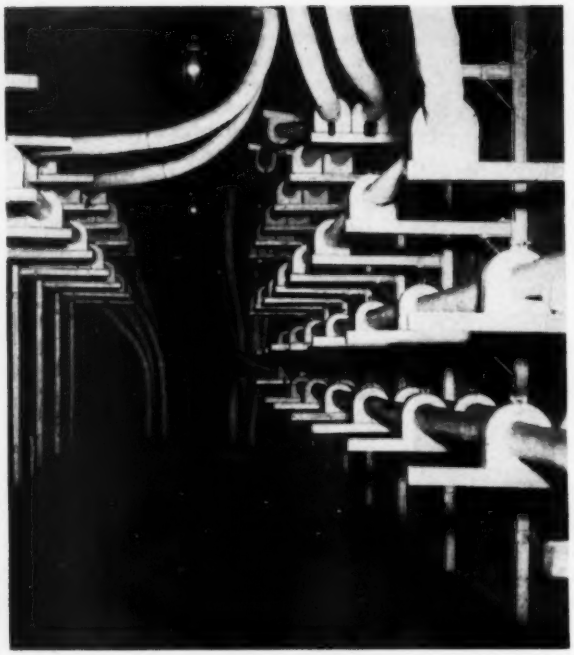


Fig. 4—Cable vault is below main switchgear. Adjustable supports in vault and manholes facilitate feeder changes

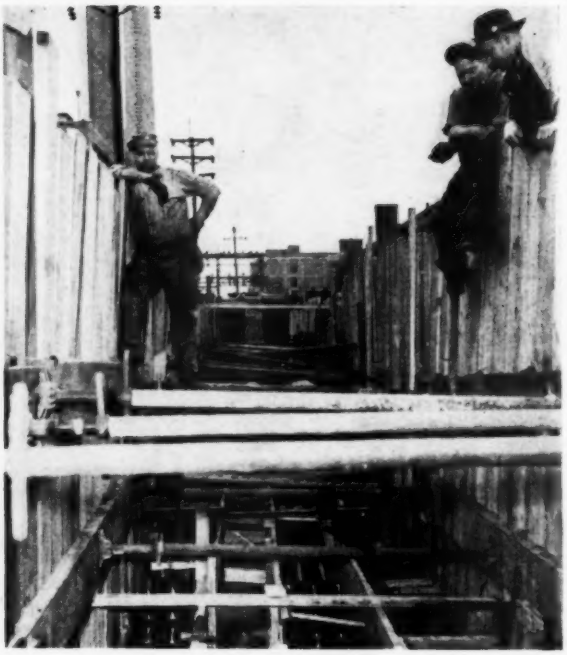


Fig. 5—All primary feeders are underground in fibre ducts encased in concrete. 8500 feet of trench were necessary

method of handling the lines in the vaults and manholes, with supporting frames which are adjustable to facilitate later additions. Cables have a grounded sheath over the insulation.

The manholes, totaling 32, have a hexagonal shape, 8 ft across the flats in most cases, although some are 10 ft. Bricked-up windows were left for future duct connections.

There are approximately 16 miles of 4 in. fibre duct in the 8,000 to 9,000 ft of the new underground system. It was necessary to break up one mile of concrete during trenching.

Two groups of eight ducts each are visible at the bottom of the trench, Fig. 5, for one of the main arteries of the system. The ducts are arranged on 6 in. centers and held in place by spacers until they are completely encased with at least 2 in. of concrete. A minimum of 4 ft. of fill was allowed above the ducts, but in many cases it was necessary to go below steam tunnels, sewers, and even city streets and sewers. A complete field survey was necessary to insure proper drainage in the ducts. Whenever possible, ducts were aligned with location of columns of future buildings.

The underground feeders terminate in the new load center substations, most of which are on ground level. Where the load is heavy and space is limited, there are some underground units. A typical station, Fig. 6, has a 1000-kva, 13,200/460-v, 3-phase power transformer next to the associated load circuit breakers on the left. Connections are delta-delta. A similar 500-kva transformer and switchgear, on the right, is used for lighting with a delta-wye connection to provide a 208-v, 3-phase, 4-wire system with 120 v to neutral. The space in the background of the photo is adequate to accommodate at least another 1000-kva power transformer and switchgear for increased load. In heavily loaded and congested areas, there are some stations with two 2000-kva power units in addition to the lighting units. Each substation also has a capacitor installation seen at the extreme right foreground in Fig. 5, 180 kva of capacitance being provided for each 1000 kva of power.

Feeder connections to the substations are shown in Fig. 8, with circuit numbers corresponding to those in Fig. 3. Note that a feeder circuit is con-

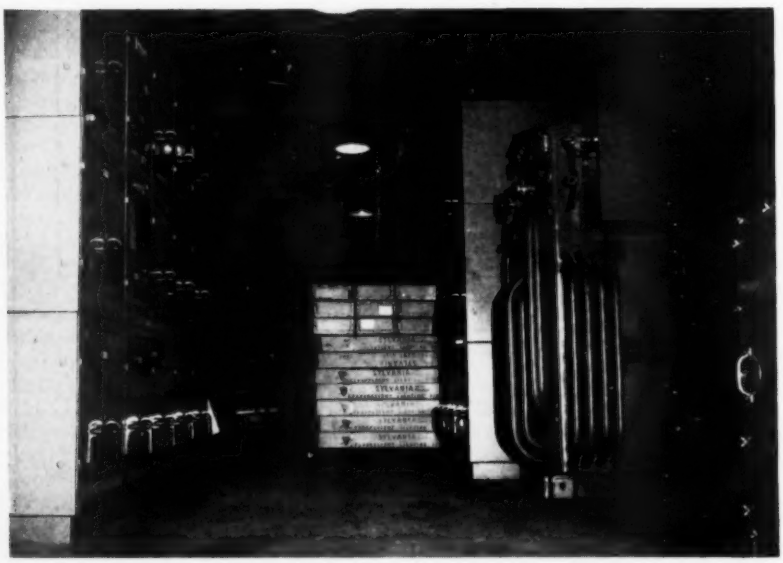


Fig. 6—Typical substation has 1000-kva power transformer and switchgear, left, 500 kva for light, right, capacitors, right front, and room to double capacity

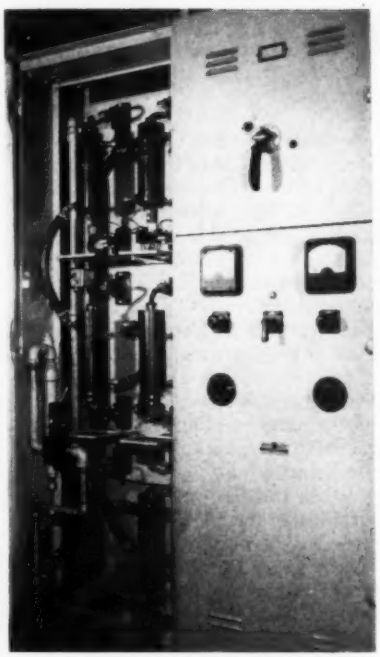


Fig. 7—Unit substations are adapted to local needs. This one has a d-c unit

nected to a power transformer through a double pothead, brought out and run to a lighting transformer, then to a power transformer and so on within the capacity of the line. The feeders are run in groups of two or three and service alternate transformers so that adjacent power or adjacent lighting transformers are on different feeders. The secondaries are connected through normally open tie breakers and, in case of fault on one feeder or transformer, its load may be immediately transferred to the substation on the companion line.

Internal connections for the unit substations between the incoming primary distribution feeders and the low voltage secondary feeders to the individual load areas in the building are shown more in detail in Fig. 9.

The double pothead for the incoming feeder connection to the transformer is one of the novel and interesting features of the system. It provides the junction between the feeder and the primary through a disconnecting switch at the transformer itself. See Fig. 6. Also, the disconnect and the main secondary breaker are interlocked so that there is no chance of developing a high voltage on the primary terminals because of feedback through the emergency secondary tie connection to the companion substation.

The unit in Fig. 9 is for power and has the 180 kva capacitor bank. The load is metered directly after the main secondary breaker. The current transformer after the capacitor and secondary tie connections is for the capacitor relay. This particular unit also supplies d-c through the two 150 kw ignitron panels. Otherwise, the lighting unit substations are similar except for size.

The capacitor load is varied automatically to match the power load. Current relays are used for this application because they have higher torque and are sensitive to load variations.

As might be expected in an automotive plant, there are a great many resistance welders. Most of the load consists of gun welders, hand operated and with non-synchronous timing. Nor are they interlocked to prevent simultaneous firing, so that none or all might be on the line at any one time. Ordinarily, flicker busses might be recommended to keep the resulting voltage variations out of the rest of the power supply.

In this case, however, the various types of manufacturing operations are frequently shifted about the plant and the designers of the system wished to allow for the connection of any reasonable load at any location. Analysis indicated that it would be cheaper to reduce the voltage variations caused by the welders by providing extra feeder capacity than by building a duplicate distribution system for the welders alone. Therefore, welders under 200 kva per unit are connected to the feeders along with other types of loads except in heavily loaded areas where one of the feeders serving the area is reserved for resistance welding.

The low voltage load feeders leading out lower part of the diagram in Fig 8 are carried in 3 in. conduit to various areas on the ground floor. Those running upwards in the diagram are in 3 in. vertical conduit taking the power to the upper floors of the building. The feeders terminate in pull boxes and tap boxes for connection to the 400 and 600 amp bus ducts that provide horizontal, local distribution to the utilization areas on that particular floor.

Density of the power load, averaged for the various manufacturing areas of the plant, is 8 to 16 w per sq ft. A new lighting system is being installed and has a power density of 2 to 3 w per sq ft.

All of the primary system was contracted for and installed by the Hatfield Electric Co., Inc. The secondary system was let to local contractors.

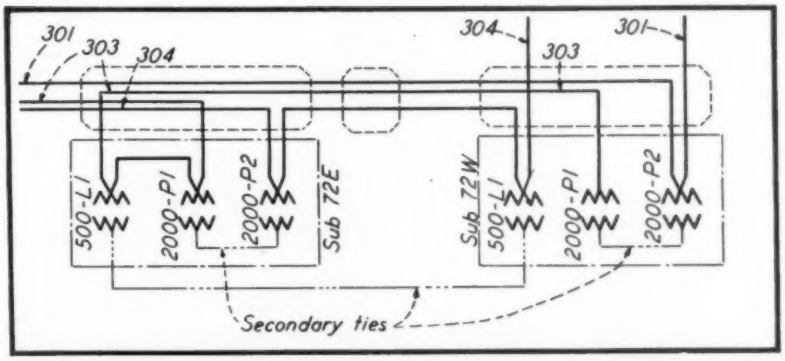


Fig. 8—Primary feeders connect alternately to power and light units. Secondary ties to units on companion feeder carry emergency load in case of power outage

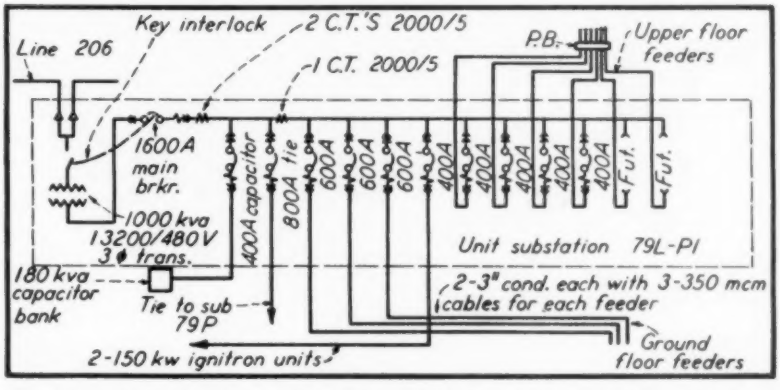


Fig. 9—Double pothead connects primary feeder to transformer. Disconnect and breaker interlock avoids feedback. Secondary feeders join bus duct in work areas

THE DUAL-CIRCULATION BOILER ....

Using two heat absorbing sections in one setting, this unit can use high percentages of makeup because furnace tubes are supplied with water of low concentration. Arrangement of circulating systems is such that carryover of silica and other solids is low

THE DUAL-CIRCULATION boiler permits maintaining low concentrations in the section most intensely heated and from which most of the steam is released. Thus what little moisture is carried in the steam is from high purity water, which means less solids carryover. Carrying higher concentrations in the other less-intensely-heated section results in a significant reduction in blowdown.

This type boiler utilizes the principle of stage evaporation and uses separate heat absorbing sections, each having its own independent circulating system. This is the same as having two separate boilers in one setting, where the blowdown from one serves as feed for the other. Concentration is maintained at a considerably lower value in the first or primary section than in the secondary section of the boiler.

Consequently, even when feedwater concentration and makeup is high the primary or furnace section can be subjected to high heat-absorption rates safely. The ratios of concentrations in the two sections depend on the amount of steam generated in each section and the amount of blowdown from the secondary sections. Fig. 3 represents the concentration ratios, which obtain for various ratios of secondary-section steam generation, boiler output and for different rates of blowdown.

The effect of any steam contamination from the secondary section can be greatly minimized or entirely eliminated by: (1) maintaining low steam release rates and low steam velocities in the steam space of this section, (2) condensing all or part of the steam generated in the secondary section or (3) washing and scrubbing the steam from this section with feedwater.

Even with extremely high concentrations in the secondary section, the maintenance of low steam release rates will preclude the possibility of foaming and excessive moisture carryover from this particular section.

When the feedwater temperature is sufficiently low, all the steam from the secondary section may be condensed, which means that the solids or vapors in steam leaving the unit will be in equilibrium with the moderately concentrated water in the primary section.

Scrubbing Action

When the feedwater temperature is too high to condense more than just a small part of the steam generated in the secondary section, scrubbing action of the feedwater will materially reduce the steam contamination, as this tends to shift the equilibrium of the steam from the concentrated boiler water to the feedwater, which has a much lower concentration.

Heart of the 3-drum dual-circulation boiler is the steam-drum internals, Fig. 1. Circulating mixture of steam and water in the waterwall tubes enters each desteamer through a rectangular slot in its side. The eccentric admission at this point induces in the circulating emulsion of steam and water, a strong whirling core whose diameter varies with the loading

Steam-free water is forced into the corners, and because of the increased pressure that results from the conversion of the rotational energy to static pressure, this water drains freely to the waterspace of the drum. Part of the steam-free water leaving the de-steamers enters the primary section downcomer and part flows to the secondary section through connecting tubes located at the ends of the drums. The steam, after first flowing through a central orifice at the top of each de-steamer, passes through a chevron drier in which practically all of the residual moisture is removed.

Steam from the secondary section flows to the condensing compartments in the primary section steam drum and

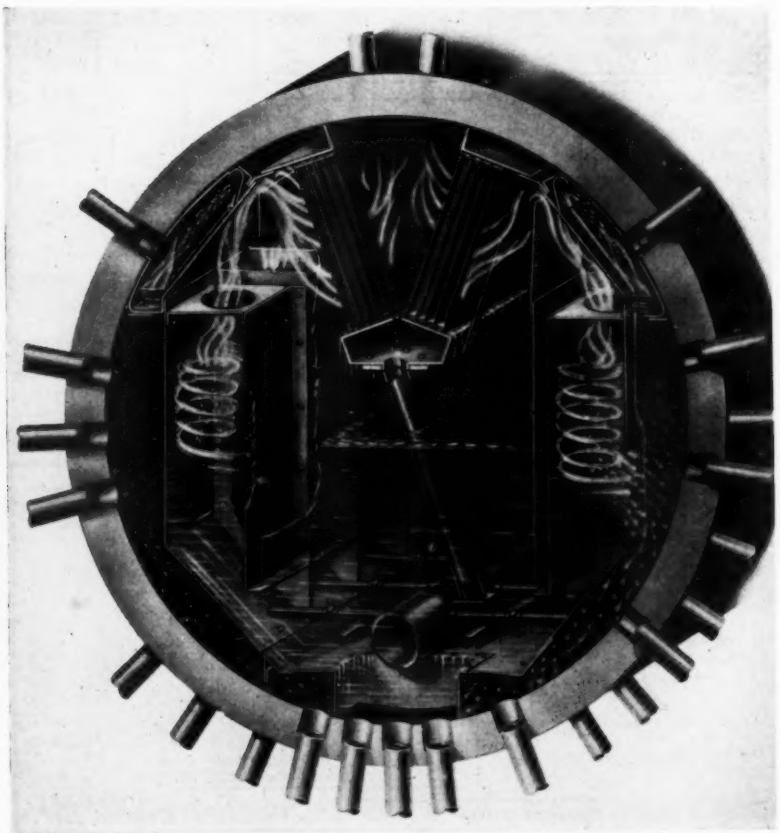


Fig. 1—Heart of dual-circulation boiler is the steam-drum internals, because they feed the secondary section with water of maximum concentration from primary

Abstract of paper presented at the Midwest Power Conference, held in Chicago, Illinois, April, 1950

WHAT IT IS AND HOW IT OPERATES

ROBERT A. LORENZINI, *Mechanical Engineer, Research Department, Foster Wheeler Corp.*

the proportion of steam condensed depends on the feedwater temperature. Intimate contact of the steam and feedwater is achieved by transforming a series of jets into sheets of water by means of a turning baffle.

The combination of large exposed surface, good mixing and high heat-transfer rates insures rapid condensation of the steam. The feedwater and condensed steam join the circulating water at the center of the drum and, because of the distance between this and the connecting tubes through which the blowdown flows to the secondary section, no dilution can occur.

Fig. 4 shows the arrangement of drum internals for the two-drum boiler. Shaded part represents the secondary or high-concentration section while the unshaded part represents the primary or low-concentration section.

Circulating mixture of steam and water from the furnace tubes enters the primary section de-steamer and part of the steam-free water enters the primary section downcomers, while the remainder flows through blowdown orifices to the secondary section. Water flowing through the blowdown orifices is the feed for the secondary section.

Steam and water from the secondary section are guided by baffles to the secondary section de-steamers, whence part of the water enters the secondary section downcomers and the remainder constitutes the blowdown to waste. Steam from the secondary section de-steamers flows to the condensing or washing section where all or part of it is condensed by the feedwater. The feedwater and condensate mixture then enters the primary section from the ends of the drum.

Main Advantages

While the dual-circulation boiler (1) makes possible the maintenance of relatively low concentrations where heat absorption rates are high, (2) permits the generation of steam of unusually good quality and (3) reduces the blowdown losses, a perhaps more important advantage is realized at higher pressures because it reduces silica carryover in the system.

When this type unit is used, silica concentration in the primary section, where most of the steam is generated, can be maintained at a lower value than in a conventional boiler. Consequently, the amount of silica appearing in vapor form in the steam from the boiler will be greatly reduced, particularly where steam from the secondary section is con-

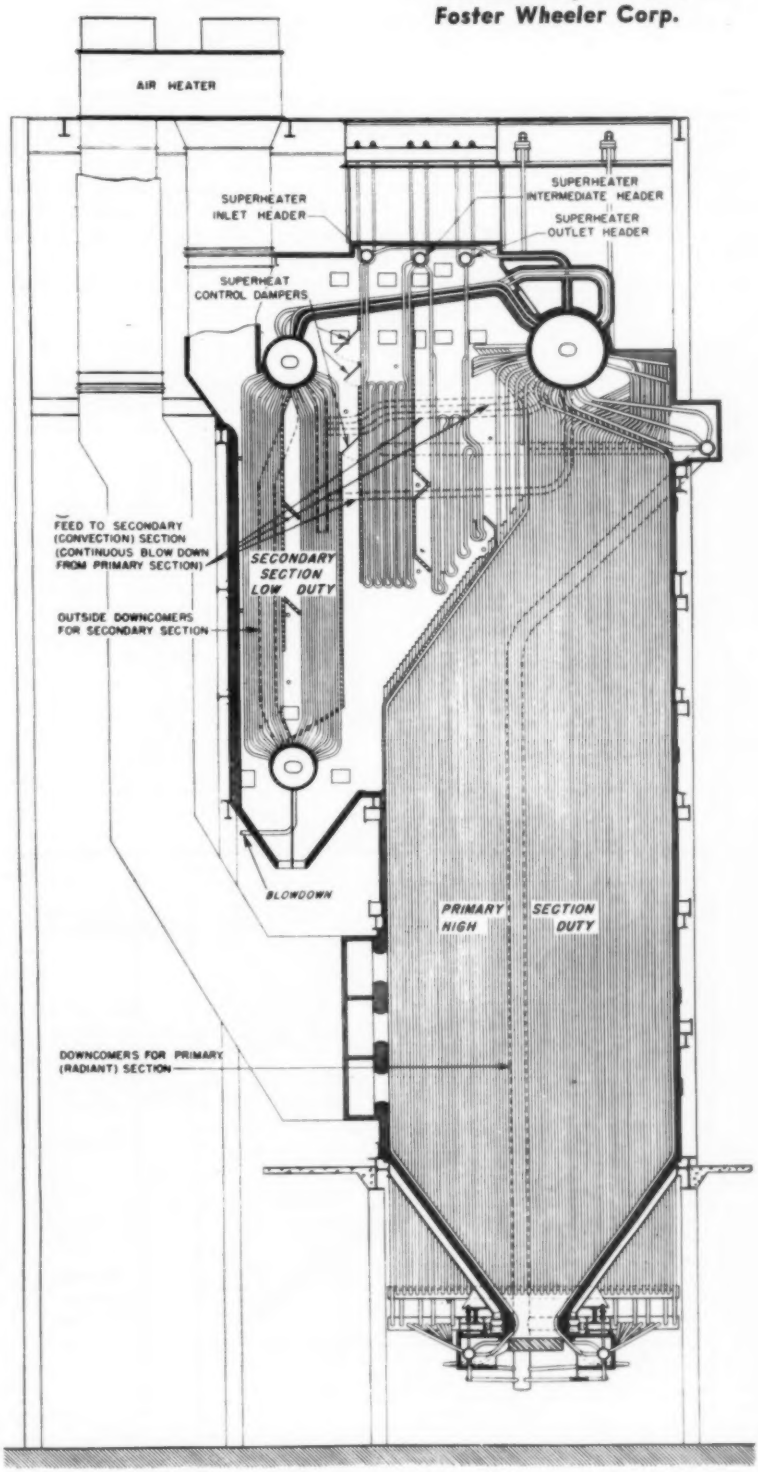


Fig. 2—Three-drum unit designed for 300,000 lb per hr at 1400 psi and 900 F. The results of circulation tests by pitot tubes and water density are shown in Fig. 5

densed or washed with the feedwater.

Calculations were made to compare total solids and silica carryover from a conventional and dual-circulation boiler using high feedwater concentration and also with good feedwater. Silica contamination was estimated from laboratory data of Professor F. G. Straub, which show that the silica appearing in vapor form in the steam is a function of the silica concentration in the boiler water, the pH of the boiler water and the pressure.

Where a condenser is used, most of the silica vaporized from the secondary section will go into solution in the feedwater and the amount of silica leaving the condenser depends on the properties of the feedwater and condensate rather than on those of the boiler water in the secondary section. In using a washer or scrubber, some of the silica vaporized in the secondary section goes into solution with the feed and consequently the contribution of this section to the total silica carryover is lessened.

In the first installation of a three-drum unit, Fig 2, numerous tests were made to measure the circulation as well as the purity of the steam from both boiler sections. This unit is designed for 300,000 lb per hr at 1,400 psi and final steam temperatures of 900 F.

Feed for the boilers is 100% Lake Michigan water which, after some preheating, is treated in hot lime-soda-phosphate softeners employing mechanical agitation and sludge recirculation. The water is heated to 240 F in the softeners and after filtration enters the steam drum of the primary section. No chemicals are usually added directly to the boilers. Results of the circulation tests are shown in Fig. 5.

Even though the water level was varied from 7 in. below to 8 in. above normal, no appreciable change in circulation was noted at any particular rating, nor was any steam entrainment detected in either downcomer section.

Circulation Ratio

Circulation ratio is defined as the ratio of the water supplied each section, to the steam generated in the respective sections. The reciprocal represents the average steam fraction by weight leaving the sections. In these tests the ratio of steam generated in the primary section to that in the secondary section was somewhat below the anticipated values due to the abnormally high excess air maintained.

Tests were also made to measure the carryover of solids determinable by conductivity and also of the soluble silica. Soluble silica in the steam and boiler water was determined by means of a spectrophotometer using the latest available techniques. Results of these tests are given in the table.

While total-solids concentration in the secondary section was varied from 900 to 2,000 ppm, silica concentration in the secondary section varied from 9.3 to 23.4 ppm and in the primary section it was about 3 ppm. Blowdown was calculated on the basis of chloride

SOLUBLE SILICA IN STEAM OF A THREE-DRUM DUAL-CIRCULATION BOILER

Test	1	2	3	4	5
Boiler rating, M lb per hr	290	303	211	301	291
Total dissolved solids, ppm					
Feedwater	144	144	144	113	126
Primary section	257	309	278	284	241
Secondary section	918	1990	900	1864	1898
Soluble silica in water, ppm					
Feedwater	2.15	1.80	1.23	1.29	1.17
Primary section	3.14	3.60	2.76	3.39	2.67
Secondary section	10.8	23.3	9.3	23.2	23.42
Blowdown (% boiler rating)					
Secondary section from Cl	16.2	8.7	—	6.8	5.7
Secondary section from SiO_2	22.8	8.1	15.5	5.9	5.3
Primary section from Cl	57.4	56.4	—	43.2	44.6
Primary section from SiO_2	78.5	52.5	52.5	38.0	46.2
Soluble silica in steam, ppm					
From secondary section, anticipated	.033	.054	.030	.065	.065
From secondary section, measured	.020	.052	.039	.030	.037
To superheater, anticipated	.011	.013	.012	.012	.011
To superheater, measured	.013	.023	.008	.010	.009

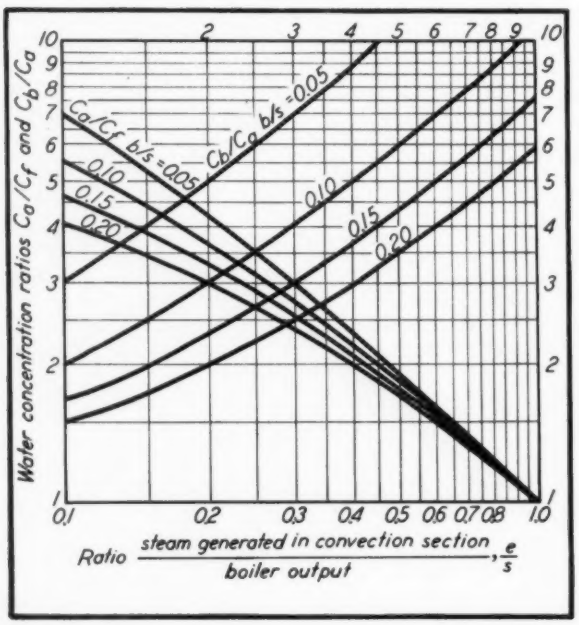


Fig. 3—Cf, Ca and Cb are solids in feedwater, primary and secondary blowdown. Boiler blowdown is b, output is s

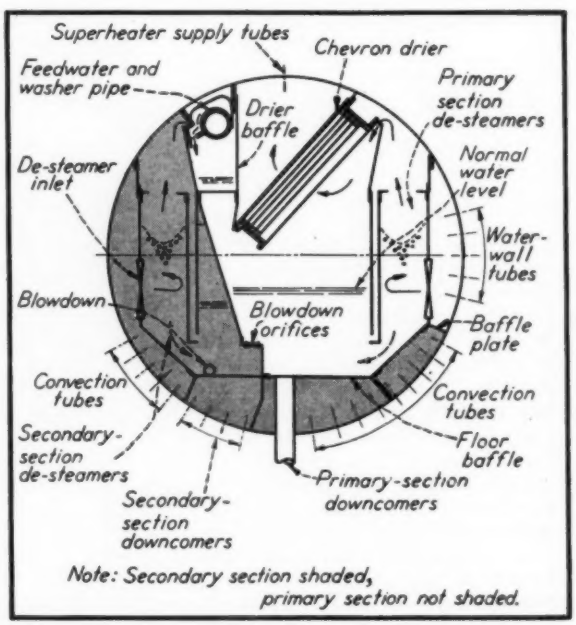


Fig. 4—Drum internals for 2-drum unit. Shaded part is secondary section, unshaded shows primary (low concentration)

and silica concentrations, and in general the agreement was good.

The soluble silica content of steam to the superheater was estimated on the basis of Straub's laboratory test data and was found to agree quite favorably with actual results. Silica content in the steam from the secondary section was also found to be in accord with the anticipated values.

With 1,000 ppm in the blowdown from the secondary section, carryover from the unit was 0.2 ppm or less at all water levels from 8 in. below to 8 in. above normal. With 2,000 ppm in the blowdown, carryover rose with the level, but even when the level was 8 in. above normal, carryover from the unit was less than 0.6 ppm.

Suitability

The dual circulation boiler is particularly suitable where steam of high purity is to be generated from feedwater high in silica or solids, and where make-up is also high. It results in the maintenance of relatively low concentrations in the furnace tubes where heat absorption is high, and hence insures adequate protection and maximum life.

The reduction in blowdown, which is made possible, effects a savings in the cost of a chemical treating plant, but perhaps of greater importance is the reduction of heat losses, which usually result when it is necessary to maintain low concentrations in a high-pressure unit.

When steam from the secondary section is condensed, all the steam leaving the boiler will have been generated in the primary section, where concentration is low. Consequently the salts, including silica, in the steam will be in equilibrium with this water rather than with the more highly concentrated water in the secondary section.

When steam from the secondary section is scrubbed with feedwater, carryover from this section will be reduced in proportion to the completeness of the exchange of feedwater droplets for the more highly concentrated droplets of the boiler water.

Instrumentation and controls required to operate a dual-circulation boiler are the same as for a conventional single-stage boiler. Control of boiler water conditions is simplified because a variation of blowdown or rating has little effect on the concentration in the primary section, and also because equilibrium boiler water conditions are quickly attained.

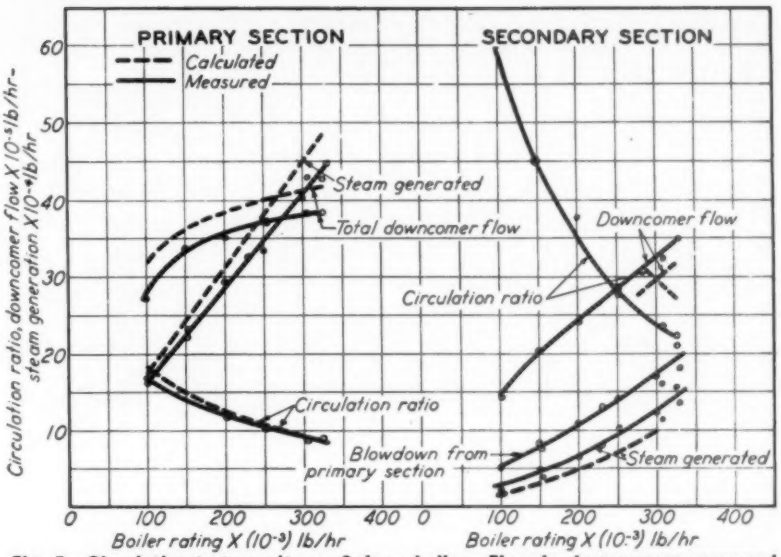


Fig. 5—Circulation-test results on 3-drum boiler. Flow in downcomers measured by pitot tubes and water density by pressure differential between static taps

These Safety Precautions Prevent Superheater Failure

●When the proper water level is maintained, boiler tubes are always in contact with water, but a different situation exists in the superheater where steam, instead of water, is the cooling medium. But no steam will flow through the superheater unless there is a pressure differential between inlet and outlet headers, and the tubes are clear of condensate. To obtain this differential, steam must be passing through.

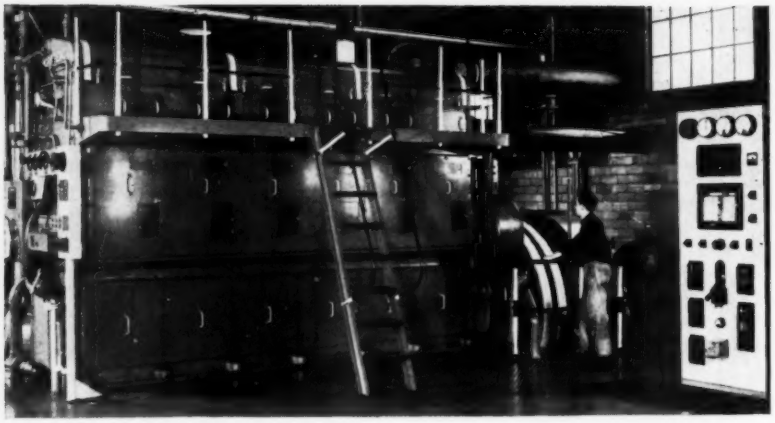
On a startup, the superheater tubes are swept by hot gasses, but no steam passes through them until the boiler water has reached the steaming temperature and the header valves have been opened. Even then, the steam will pass only through those tubes that have been cleared of condensate. Likewise, when a boiler is suddenly taken off the line, or loses its load, heat will continue to be applied to the superheater tubes for a time. And, unless the superheater safety valves are blowing, no steam will cool the tubes.

A drain, installed on the superheater *outlet* header, provides a means to obtain flow through it when the boiler is not delivering steam through the main line. When starting up the drain valve should be opened wide until the boiler is ready to carry load. A partly-open valve does not give enough flow to protect the entire unit. Use the superheater *inlet* drain to remove condensate.

Putting a boiler on the line quickly requires a large release of heat in the furnace to generate steam rapidly. Thus, large quantities of steam must pass through the superheater at high velocity. Under extreme conditions it may even be necessary to furnish steam from other boilers to keep the superheater cool until the boiler goes on the line.

If the superheater is of the inverted type, the condensate will collect in the headers where it can be removed through the drain lines. In pendant-type superheaters, however, the headers are above the tubes, and condensate can not be removed by gravity drainage. Most common and reliable method of clearing the pendant type is to evaporate the condensate by firing the boiler slowly to avoid excessive flue-gas temperature at the superheater.

It should be kept in mind, however, that when the boiler begins to generate steam some of the tubes will be blown clear by the steam pressure, but the remainder will still contain trapped condensate. Firing rate should be held down until all tubes are open. The length of time required to clear the superheater of all condensate varies with the size and type of boiler, but tests made in a number of plants showed that the time usually allowed was not sufficient to evaporate all the condensate. —The Locomotive.



GAS-BURNING

A. J. WOLF, *Superintendent, Elkhorn Municipal Power Plant*

Believed to be the only diesel operating on gas in Wisconsin, this dual-fuel engine generates half of electric power load required by city of Elkhorn

WHEN NATURAL GAS became available in Wisconsin, piped 800 miles from its source, the Light and Water Commission of Elkhorn decided to install a dual-fuel diesel to carry approximately one-half the city power load. Accordingly, a Nordberg DUAFUEL engine was purchased and placed on the line in July, 1949. This engine is a four-cycle six-cylinder supercharged unit with a 16-in. bore and 22-in. stroke; it drives an 875-kw 2400/4160-v three-phase 60-cycle Elliott generator with a 15-kw exciter.

Normally, the engine burns gas, but during periods of extreme cold weather when there is a shortage of gas, it is necessary to switch the engine to oil fuel. During the winter of 1949-1950 the total time that the engine was off the gas line was only 20 hr, the longest single period being 6 hr.

Since the engine does not have sufficient capacity to carry the entire city load, it is operated in parallel with the Wisconsin Gas and Electric Co. system. This accomplishes two purposes. First, it smooths out peaks of the city service, thereby lowering the demand charge and reducing the overall rate of purchased power; second, it provides some stand-by service in case of a failure of high-line service. The engine is held at practically full-load capacity with unit power factor from 7 a.m. to 10 p.m. six days a week. During this period, only the demand in excess of the load carried on the engine is supplied by the utility system, which also carries all the city load when the engine is not in service.

Since the engine operates on constant load, there is little difference from month to month in the various expense items that enter into the cost of generation. Operating data for the first four months of 1950 are given in the Table.

Including gas, pilot and fuel oil, lube oil, labor and maintenance, operating cost is .603 cents per kwhr. This compares with 1.25 per kwhr for purchased power. During these four months, the engine operated for a total of 1537 hr. Since 1,354,922 kwhr were generated, the engine was carrying an average load of 881 kw, which was slightly beyond its full-load rating.

For the month of March it will be noted that the amount of pilot and fuel oil was much higher than for any of the other three months. This was caused by cold weather when the engine had to go from gas to oil fuel on several occasions.

The Elkhorn power plant is located adjacent to the main of the Wisconsin Southern Gas Co. A 4-in. line carrying gas at 50/55 psi pressure goes to the gas company's regulators, where the pressure is reduced to about 14 psi. After passing through two gas meters arranged in parallel, the gas is again piped outside the building to a scrubber, which also serves as a combined reservoir and surge tank.

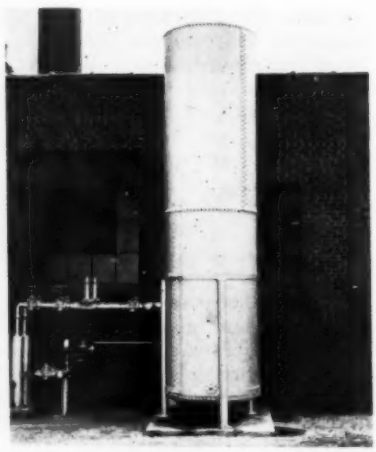
Oil used for pilot fuel, and for regular operation when gas is not available, is delivered by tank car to a siding which runs through the rear of the plant property. There are two storage tanks having capacities of 15,300 and 27,500 gal with unloading facilities consisting of a Viking transfer pump driven by a 3-hp Master motor.

Oil from the storage tanks flows by gravity through a Trident filter, a Trident meter and then to the built-in fuel transfer pump on the engine which delivers oil to the fuel header. There is also an overhead day tank of 300-gal capacity to which fuel can be transferred by a Roper 3-gpm 40-psi pump driven by a ¼-hp General Electric motor and located in the pit adjacent to the engine.

The cylinders are lubricated by a 12-feed Manzel force-feed lubricator mounted at the control end of the engine. Bearings and other engine parts are lubricated by a circulating pressure system utilizing a built-in gear driven pump located on the operating side of the engine adjacent to the flywheel. Oil returns to a sump in the bedplate. The pump takes its suction from the sump and forces the oil through a Nordberg duplex strainer, through a Ross lube oil cooler having a capacity of 550,000 Btu per hr, and then to the lube-oil header on the engine for recirculation. A HILCO purifier operates continuously, taking oil from sump, purifying it, and returning it to the sump supply. This purifier has a capacity of about 2 gal per min.

There is also an auxiliary lube-oil pump. This is a Roper rotary unit of 130-gpm capacity at 50 psi. It not only serves in an emergency should there be a failure of the built-in pump, but it also serves as a before-and-after lubricating pump.

One noticeable advantage in the use



After metering, the gas is piped to the engine via this combined regulator and surge tank outside of the plant

DIESEL CUTS POWER COST 50 PER CENT

During past winter, dual-fuel engine was off the gas line only 20 hr. Operating at constant load, it generated power at a cost of .603 cents per kwhr, compared with 1.25 cents for power purchased from utility

of gas fuel is the lack of contamination and the long life of the lubricating oil. Over a four-month operating period, the engine showed a lube oil consumption of 1 gal per 4,301 kwhr. This good showing in lube oil consumption has a definite bearing on low power generation costs. Lack of contamination obviously minimizes engine wear, increases engine life, and lowers maintenance expense.

Cooling water for the engine is taken from one of Elkhorn's deep wells, and is discharged into a 275-gal tank located just above the floor and back of the engine. At the outlet of this tank is a Y-connector, one branch going to the lube-oil cooler, the other to an Allis-Chalmers ELECTRIFUGAL raw-water pump, driven by a 15-hp motor, with a capacity of 300-gpm at 90-ft head. It discharges through a Ross heat exchanger which has a capacity of 1,710,000 Btu per hr.

After passing through the heat exchanger, the water is carried to an old well and returned to the ground supply. All city water is treated; consequently, soft water is available for the engine jackets. This water is circulated by an Allis-Chalmers ELECTRIFUGAL 300-gpm pump at 70-ft head and driven by a 10-hp motor. In this circuit is a 50-gal overhead surge tank.

The plant at Elkhorn is exceptionally quiet in operation due to effective silencing. A concrete structure houses an American air filter on the suction line, while a Burgess-Manning snubber quiets the exhaust. On the exhaust line is a Zallea flexible connector to care for expansion.

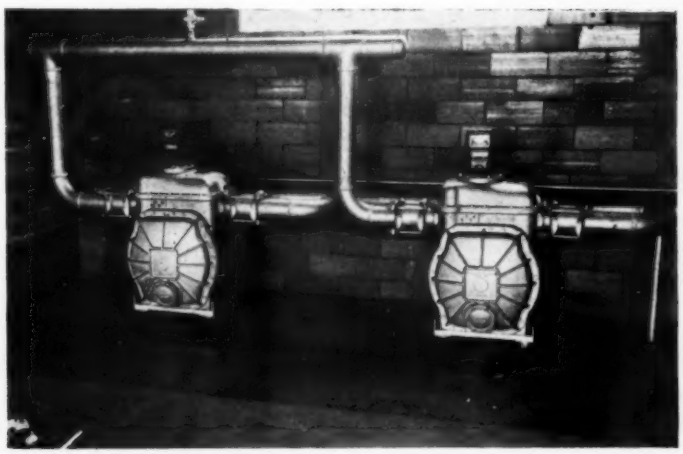
A panel on the operating end of the engine has push-button controls for the auxiliaries, and a Viking alarm for lube-oil and jacket-water pressures and temperatures. This alarm functions should the oil or water pressure drop below 15 psi, and the temperature of either rise above 150 F.

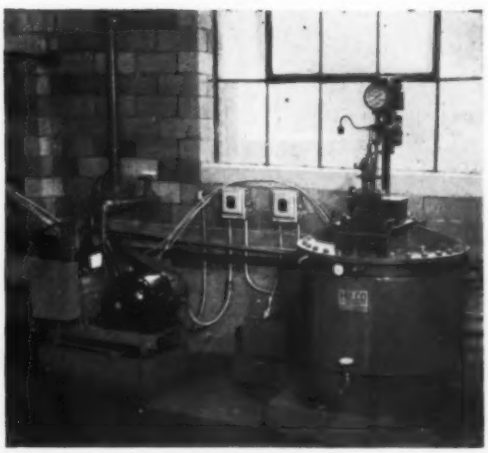
Air for starting is supplied by an 11-cfm, 250-psi Gardner-Denver air compressor with 5-hp motor.

While the diesel engine generates less than half of the city's requirements, the savings being made definitely prove that the installation is a good investment and that greater savings would be possible if the entire city load could be carried by diesel engines. Their installation is a part of a long-range expansion program for the city's utilities.

PERFORMANCE AND COST DATA FOR ELKHORN DUAL-FUEL DIESEL

	January	February	March	April	Total, 4 mos.
Engine hours	363	391	392	391	1,537
Power generated, kw-hr	325,940	344,600	345,442	328,940	1,354,922
Gas consumption, cu. ft.	3,214,000	3,465,000	3,207,000	3,375,000	13,261,000
Gas cost, dollars	1,392.40	1,463.70	1,390.30	1,394.80	5,741.20
Fuel-oil, gal.	772	903	2,751	929	5,355
Fuel-oil cost, dollars	84.92	99.33	302.61	102.19	589.05
Lube-oil, gal.	72	72	91	80	315
Lube-oil cost, dollars	38.88	38.88	49.14	43.20	170.10
Labor charges, dollars	410.00	410.00	410.00	410.00	1,640.00
Maintenance charges, dollars	.....	40.00	.....	.....	40.00
Purchased power:					
Kw-hr	429,600	439,200	360,000	355,200	1,584,000
Cost, dollars	5,370.00	5,270.40	4,608.00	4,511.04	19,759.44





Left: Before passing through these two gas meters arranged in parallel, gas from a 4-in. main is reduced by gas company regulators from 50/55 to 14 psi. It is then piped to the engine via a scrubber, which also serves as combined reservoir and surge tank. Right: Starting air compressor, and lubricating oil purifier which operates continuously at capacity of 2 gal per min.

THEORY, DESIGN AND APPLICATION OF PNEUMATIC CONVEYING SYSTEMS

Factual information on the theory, application and design of pneumatic conveying systems is treated in an easy to understand manner. The principles of the three basic types—draw through, blow through and combination of both—are explained

WILBUR G. HUDSON, *Consulting Engineer*

PNEUMATIC CONVEYERS are the most interesting yet the least understood member of the material handling family. The engineering contractor has a hazardous business because results are so intimately related to the characteristics of the material to be handled. For example, a slight variation in weight, granular size or moisture content can upset the calculations by which volume, air-stream velocity and power requirements were determined. At best it is not an exact science.

About 1866 B. F. Sturtevant pioneered this field. However, his activities were centered on pneumatic removal of plant dusts and lighter materials such as wool shreds, sawdust, cotton waste and similar non-abrasives that could be drawn through an exhaust fan with little or no destructive action. As far as known, the pneumatic conveyer began to compete actively for the business of handling corrosive and abrasive granular and pulverized materials in about 1910. It then attained a major position in handling dry boiler house ashes. At English ports large ship cargoes frequently must be transferred to lighters. The pneumatic grain unloaders with capacities of 200 tons or more became accepted practice.

In the last 30 years or so the pneumatic conveyer has made rapid progress in competition. It can solve problems that mechanical conveyers cannot attempt advantageously, for example where the path or route is tortuous. The power per ton per hour is far greater, and so its field for the most part is in the small to medium capacity requirements. Outstanding features are elimination of injury risk to personnel, since there are no moving parts, and dustless operation because of "vacuum cleaner" action, as when unloading finely pulverized material from box cars through flexible hose and nozzle, Fig. 1.

Fig. 1—Automatic self-feeding action of the pneumatic unloader permits dustless operation, and this can be done without the removal of the heavy bulkhead doors

Two Pneumatic Systems

There are two systems, which are referred to as pressure and suction. Actually both are pressure systems, the latter dependent on atmospheric pressure when the pressure at the delivery end is reduced by an exhauster. Fig. 2 illustrates the pressure system, specified here because compressed air at 75 psi was ample. Bagged pulverized slate, intended for melted asphalt mix used in the manufacture of pipe covering, is received in box cars.

The slate is poured into a 6 in. duct fitted with a venturi nozzle and led to the upper part of a storage tank. The material sprays downward as the air, containing considerable dust, passes up through a muslin filter panel separator. The panels are automatically shaken clean at ten minute intervals. Rehandling from storage is similar, but the duct terminates in a centrifugal separator and is vented back to the tank. The slate flows downward into hot asphalt where it is churned by a mixer.

Suction system, Fig. 3, installed at a blast furnace plant near Pittsburgh, is a good example of flexibility and sim-

plicity of the pneumatic conveyer compared with the multiple mechanical conveyers that would be required. Coke screenings from beneath seven track hoppers feed into branch ducts leading up to the main duct, which discharges into either storage tank. Air, drawn from tanks, passes through an air washer, consisting of baffles sprayed with water, and thence to twin centrifugal exhausters. Maximum efficiency of dust elimination is essential since coke is highly abrasive and erosion of the high speed (3500 rpm.) fan blades would result in unbalancing the rotor.

Exhausters have constant pressure characteristics over a wide range of volume. Each unit will normally maintain a suction of 2½ psi, sufficient to feed material to the third hopper with one exhauster operating. When an inlet beyond number 3 is opened another exhauster is cut in automatically, and this boosts the suction to 5 psi. A governor, resembling a balanced disc, is located in the exhaust stream. As air volume diminishes, the disc rises and actuates the starter of the second exhauster and also opens a blast gate that couples the two machines in series. Conversely, if operation shifts to a nearer inlet where 2½ psi suffices, the increased volume moves the disc downward, closing the blast gate and stopping the booster fan.

Combination System

Combination suction and pressure system of a pebble lime plant in Pennsylvania, Fig. 4, offers a low power cost pneumatic conveyer system. The layout calls for a variable pressure-constant volume, positive type blower. Normally material passes from a kiln to storage direct, from A to B to C. However, when a finer product is desired, the switches S,S' are swung to divert flow through a rod mill to an airlock and back into the main duct. The blower is an 18 x 20, 9.35 cu ft per revolution unit operating at 348 rpm.

Capacity is 3200 gross or 2600 cfm net when driven with a 100-hp motor.

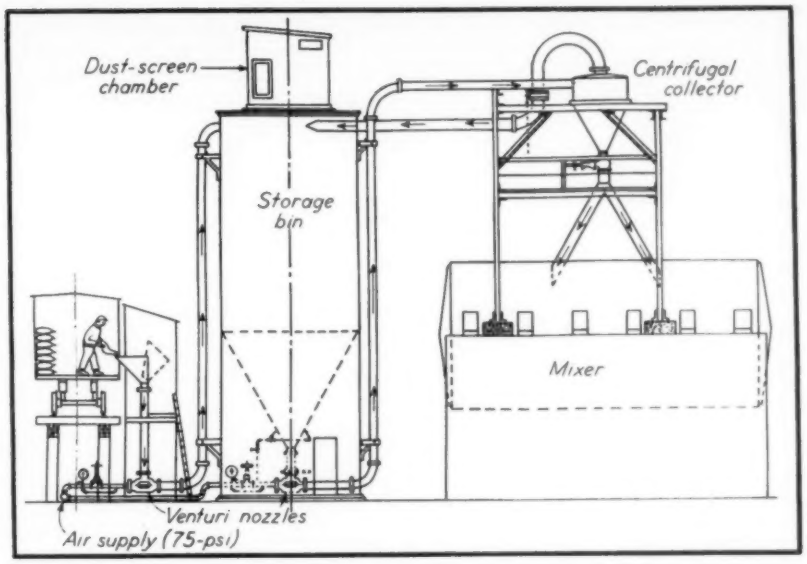


Fig. 2—This pneumatic-pressure system conveys pulverized slate to the storage area and from there to a mixer. The system is operated at a pressure of 75 psi

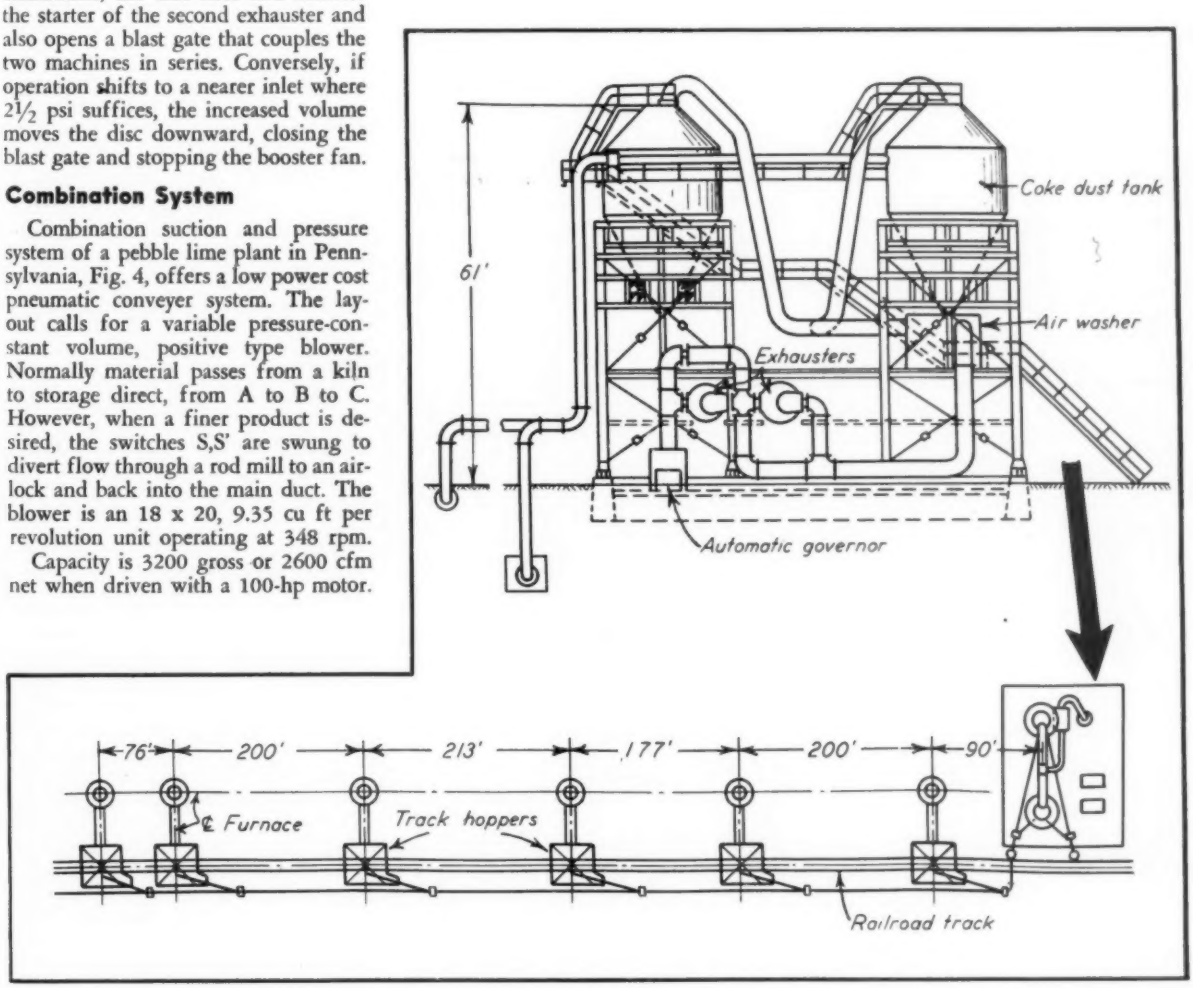


Fig. 3—Pneumatic system at this blast furnace plant handles coke breeze from under a track hopper screen to storage. Automatic control of the air velocity is maintained to suit the distance of feed points from the storage tank

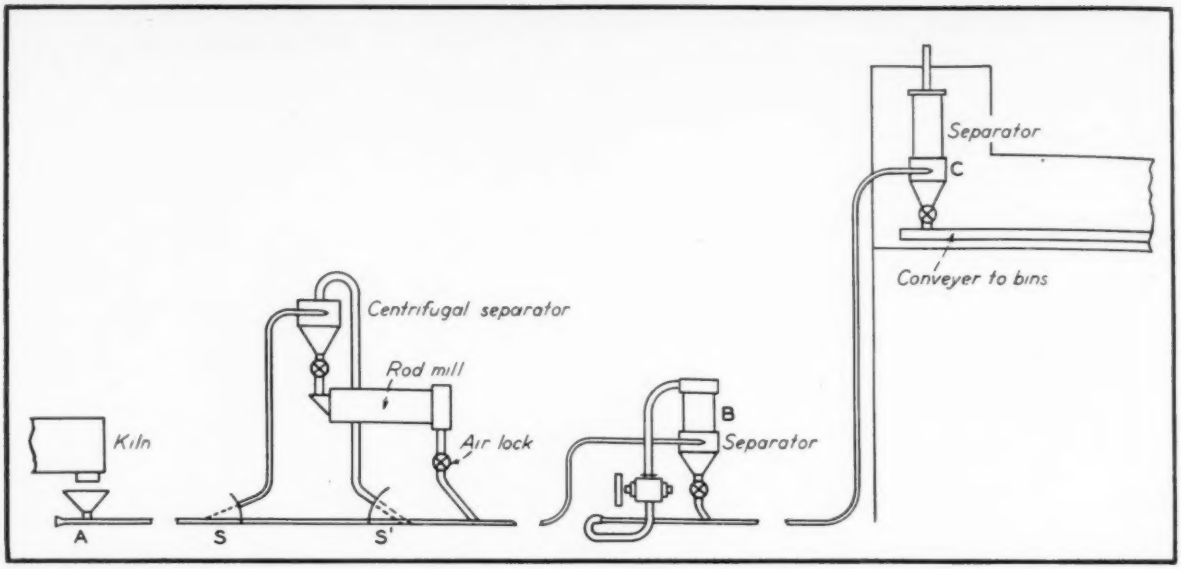


Fig. 4—Material in a pebble lime suction system is fed in at A, drawn to separator B and passes through air-lock gate to pressure line leading to separator C for distribution by screw conveyer. Switches S and S' can divert flow

Conveyer line is 6 in. and has a capacity 12 tph. With the normal movement from A to B to C, the vacuum is 3 psi, the pressure is 3 psi and the total pressure is 6 psi. Estimated horsepower is 96 while the actual horsepower was 92. When running light, the readings were, 1.75 psi vacuum, 2.0 psi pressure and 60-hp. About ⅔ of the power is utilized to maintain the air blast and ⅓ to move the load, typical of the low mechanical efficiency of the pneumatic conveyer—fortunately not a major consideration.

A typical installation for unloading from box cars through flexible hose and nozzle, Fig. 5, delivers to either service or reserve storage and reclaims from reserve to service storage.

Inhalation of industrial or chemical dusts usually is harmful, and this type of system offers a dustless operation. The only alternative in the car is the power shovel, which requires far less power (for 15-20 tph capacity the shovel requires about 5-hp—the pneumatic unloader about 30-hp.) but calls for good skill, involves risk of injury and creates a dust hazard.

Pneumatic handling of ash in steam plants of moderate capacity has been adopted quite generally, because of convenience, safety and cleanliness. Earlier systems employed a motor-driven exhauster. However, with the development of an air blast with steam jets located at the foot of the riser, the cost has been reduced, Fig. 6. Several bad features were evident: (1) the turbulence in the air-ash stream just above the jet caused rapid wear and (2) the efficiency was low—about three times the power required with an exhauster.

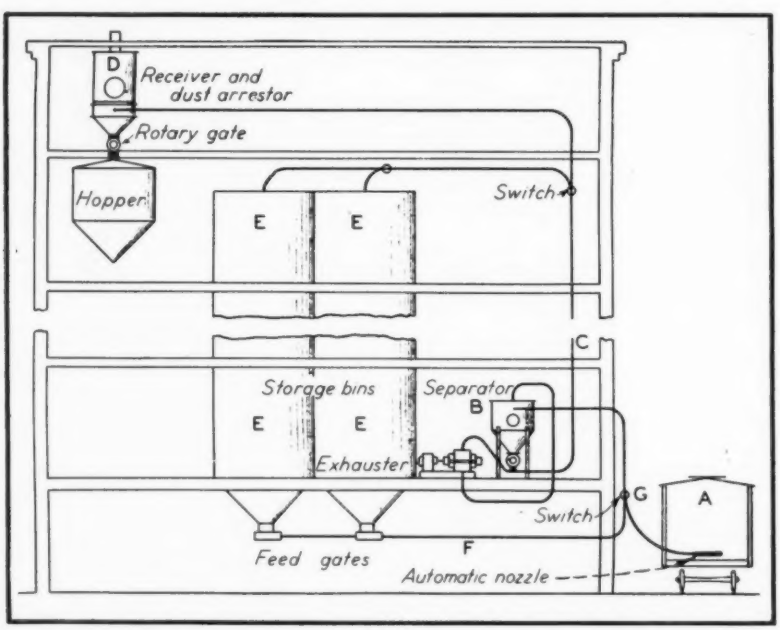


Fig. 5—Material is drawn through nozzle A, flexible hose and centrifugal separator B. It drops into an air-lock and is blown to dust collector or storage

Venturi Type System

The modern ash conveyer has a venturi type annular ejector between a centrifugal receiver or separator and a dust collector (Fig. 7). The operation is intermittent. After 200 or 300 lb of ashes enter the receiver (filling time is about one or two minutes), a relay closes a throttle, and a flap gate opens to drop the batch into the bin below. The relay then functions to close the flap gate, open the throttle and repeat the cycle.

A washer is equipped with water sprays and drains to the sewer. Exhaust steam, partially condensed, vents upward. The annular jet efficiency is much better than the single nozzle and could be further improved if the design were modified for a continuous instead of intermittent cycle.

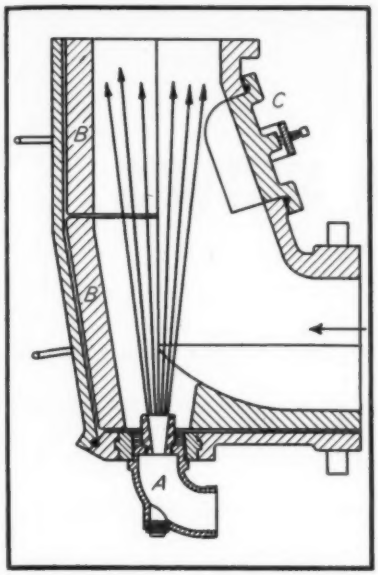


Fig. 6—Nozzle of steam jet ash conveyer is located at the foot of riser

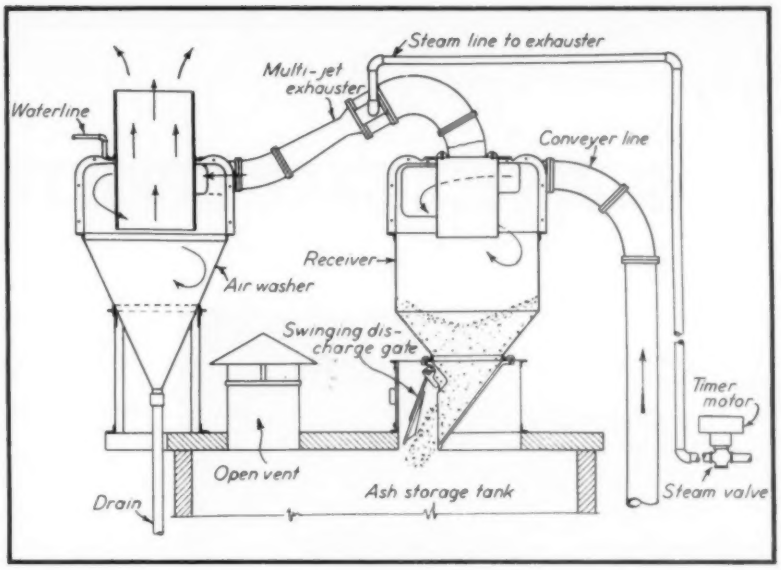


Fig. 7—Modern pneumatic ash conveyer contains venturi steam jet between receiver and air washer that provides required air velocity to convey ash in the line

Air volume and velocity required and power to produce this air blast for a given handling capacity depend on (a) weight and size of the average particle, (b) duct diameter, length and number of bends or elbows. This method is ideal for free-flowing pulverized or granular materials. However, it is not applicable for ashes as the feed is a mixture of dust and heavy clinkers that are fed to the duct usually in batches by shovelling. In an ash conveyer the air blast is made sufficient to carry along a succession of heavy clinkers with a margin for contingencies.

There are two types of pneumatic systems. One employs a large volume of air at low velocity—low pressure; the other operates with a small volume of air at high velocity. In the suction system the low pressure method is more efficient as conveying medium is denser and has greater carrying capacity than rarefied air.

In addition, frictional loss in the duct and exhauster is less. High pressure means greater slip and head losses in the exhauster. Where the line is long and the material heavy, as with cement, the pressure system has the advantage. The air is dense at the feed point and more effective in getting the material up to speed. As the air expands, the velocity increases, and once material starts to move it will continue.

Design analysis, that follows in the next issue of INDUSTRY AND POWER, is based on test readings of a large number of low pressure-large volume installations handling a wide variety of materials. These procedures were followed in determinations for proposed installations, and they have been found to be accurate within practical limits for most conditions.

Try This Test To See if You are A Heat Waster

● Some building owners are apparently losing money through heat losses from insulation faults which, if eliminated, could bring substantial returns with comparatively small investments. The Magnesia Insulation Manufacturers Association offers the following quiz to check on the efficiency of your insulation methods and materials.

Each "yes" answer rates ten points. "No" answers are zero. A score of 90-100 indicates a well insulated system; a score of 80-90 indicates only minor improvements are required; 70-80 shows the need for some major insulation changes; any score below 70 proves the need for a thorough survey by an insulation engineer to save much needed fuel and lower operating costs.

	Yes	No
1. Are all major pieces of equipment and piping insulated?	.....	.....
2. Are flanges, fittings and valves insulated?	.....	.....
3. Are condensate or hot water return lines insulated?	.....	.....
4. Has damaged insulation been repaired or replaced?	.....	.....
5. If insulation has shrunk excessively, exposing pipe at insulation joints, has it been repaired or replaced?	.....	.....
6. If insulation has deteriorated so as to impair its insulating value, has it been replaced?	.....	.....
7. Are insulation thicknesses economical based on today's fuel costs, insulation costs, operating temperatures, hours of operation, conductivity of insulation and rate of deterioration?	.....	.....
8. Have special protective finishes been applied at points where mechanical abuse, excessive moisture or hazards are likely?	.....	.....
9. Have repairs been made to torn, broken or damaged finishes?	.....	.....
10. Have loosened tie wires or bands been tightened, and corroded tie wires or bands been replaced?	.....	.....
Score		

How to Diagnose Faults in

SQUIRREL CAGE INDUCTION MOTORS

Fig. 1—Troubles often can be identified before dismantling a motor. Line tests showed this stator was due for major repairs

Symptoms and causes of the faults found in polyphase induction motors of the squirrel cage type are required knowledge for the electrical maintenance men who keep the wheels turning. Systematic tests quickly locate source of trouble and avoid delays

THOMAS TRAIL

POLYPHASE MOTORS with squirrel cage rotors are a popular power source for many types of industrial equipment. They are dependable and seldom need attention, but their widespread use on essential operations makes efficient troubleshooting a necessity. Familiarity with the symptoms of the various faults and a logical, step-by-step procedure of inspection and testing will save a great deal of time.

Overload Symptoms

Frequently the motor does not start again after having once stopped. The overload protective device in the controller, the line fuses, the operation of the controller and then the motor itself should be checked in that order. Open overload contacts or blown fuses indicate excessive current from a heavy shaft load, bearing drag or shorted motor coils.

Bearing drag may be caused by lack of lubrication, failure of the bearing or excessive wear.

For an overload test, see that the motor is not abnormally loaded, as by machines that should be disengaged during starting. Reset any tripped overload devices or replace any blown fuses. Assuming that the motor can now be started, check the operating current in each phase, a clamp-on type of ammeter being very convenient for the purpose. High equal currents in all phases point to an excessive shaft load or bearing trouble in the motor.

An abnormally high reading in any one phase may be caused by a short-circuited coil in that phase. It generally can be found by running the motor for a few minutes and noting which coil is hottest. A shorted coil should, of course, be replaced, but if it is essential that the motor be temporarily kept in service, an emergency repair may be made as shown in Fig. 2, except where an entire coil group is burned out.

The entire phase, or part of it, may become hotter than the other phases of the motor winding, usually indicating a ground. Test the defective phase as shown in Fig. 3A, and if this shows a ground, check each coil group as shown in Fig. 3B. When the grounded group is located, test each coil of the group to locate the grounded one, as shown in Fig. 3C.

Controller Troubles

If the current reading of each phase at the motor is not abnormally high, test again at the controller or line switch. A high reading here but not at the motor indicates a ground or short-circuit in the switch or controller wiring, or in the wiring between the controller and the motor. A ground test with a megger, or bell and battery test set, should then locate the fault.

Sometimes the overload device may trip from overheating of loose connections, from excessive vibration, or because the ambient temperature is too high. Vibration can be eliminated by mounting the controller in a solid location. Loose connections should be cleaned and tightened securely. An excessive air temperature requires the use of higher rated heater elements in the overload device and the controller manufacturer should be supplied with the motor name plate rating and information as to the room temperatures

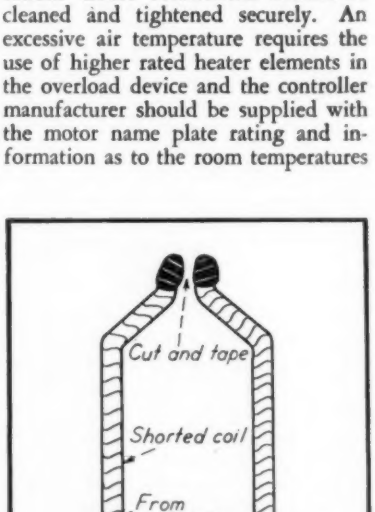


Fig. 2—For emergency only, this repair may keep a key operation in production

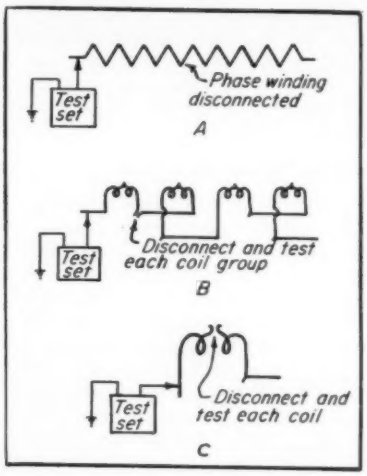


Fig. 3—Grounds are traced first to the phase, the group, and finally the coil

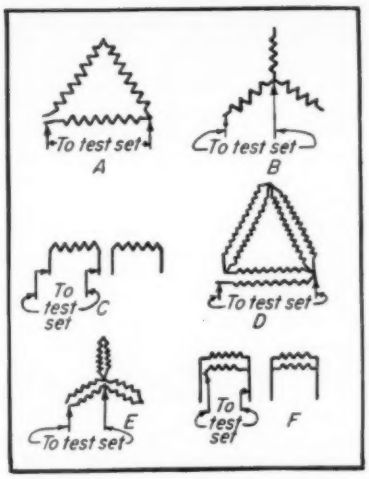


Fig. 4—Tests for open phase windings require that one lead be disconnected

so that he can furnish correct heater elements.

A temporary measure consists in keeping the controller door open, with the controller suitably protected by a screen guard. An electric desk fan may be employed to circulate air through the controller.

Blown fuses can also be caused by heating of loose connections in the fuse, insufficient clip pressure, or loose connections at the clip terminals.

When making examinations or tests not requiring operating current, disconnect the line switch as a safety precaution.

If the controller fails to operate, check the coil leads for potential. A full voltage indication usually means that the coil is open. A defective coil usually shows signs of burning or overheating, and if it exerts no operating force and the wire connections are in order, it should be replaced.

Controller Wiring

An open control circuit is indicated when no potential reading is obtained at the coil leads or terminals. In this case, check the overload contacts and each switch in the control circuit until the defect is located. It is also possible that the control circuit wiring is open or grounded.

If the controller operates but the motor fails to start, test the load terminals for voltage, which should be steady at the rated value. If otherwise, look for burned or worn contacts in the controller, or on hand-operated switches where employed. Contacts not too badly burned or worn may be dressed with a file to restore them to satisfactory condition. Very defective contacts should be replaced. The same applies to flexible shunts with more than a third of the cross section broken.

Controller failure also may be caused by an open resistor, or an open reactor or auto transformer winding.

Where controller load terminals show rated voltage, check the motor terminals to insure continuity of the wiring to the motor. Sharp-pointed, insulated test prods may be used to penetrate the insulation, and eliminate having to untape the motor connections. Tape wires afterwards.

Open Motor Circuits

If the power is reaching the motor, test the motor for open phase, as shown in Fig. 4 at A, B and C. Or where motor is connected parallel delta, star or two phase, check as shown in Fig. 4 at D, E and F.

An open phase may result from a loose connection in the jumper or coil connections. If found, carefully clean the metal at the joint, apply flux and resolder the connection. When connections are satisfactory, check coil groups in the phase, one at a time, as shown in Fig. 6 A, and then the coils in the group found defective, as shown in Fig. 6 B, to locate the open coil.

The defective coil should be replaced with a new one. However, if continued operation of the motor is temporarily necessary and only one coil is faulty, it may be shorted out, as shown in Fig. 6 C. Gang wound coils or a group of coils cannot be repaired in this manner.

Where none of the phases is open, examine the rotor for loose bars, which may appear discolored or burned since they sometimes produce sparking when the motor is running. Defective bars must be rewelded or resoldered by whichever method was originally employed in the manufacturing.

Incorrect Wiring

A recently repaired motor being run for the first time may have an incorrect winding hookup. To test this easily, remove the rotor and place a relatively large steel ball, such as used in bearings, inside the stator. Apply reduced operating voltage (full voltage on small motors) to the stator winding. Rotation of the steel ball around the stator core will indicate correct internal connections.

Where failure of the steel ball to rotate shows wrong winding hookup, connect a low voltage battery across one phase at a time and move a pocket compass slowly around the inside circumference of the stator. The compass needle should reverse direction each time it passes from one group of coils to another in the energized phase. If it fails to do so, the connections of that group are reversed.

Should the compass needle fail to give a definite indication over any group, there will generally be a reversed coil in the group, and the connections must be corrected.

An entire phase may be connected in reverse, and the compass needle will indicate three north poles followed by

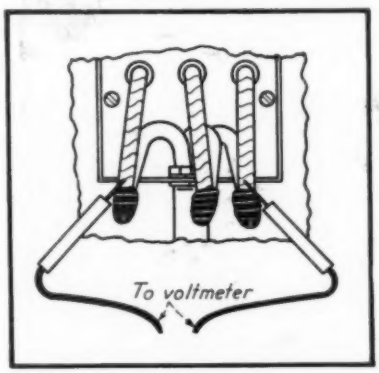


Fig. 5—Prods are convenient on taped joints. Leads must be retaped after use

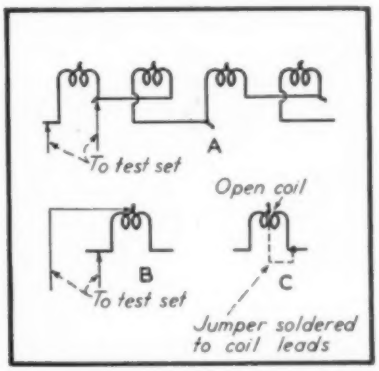


Fig. 6—Phase open circuit is traced to group, then coil. Jumper is temporary

three south poles in a three phase motor. Where this fault is found, simply reverse the connections of this phase in the motor winding.

Low Speed

Low operating speed can be caused by a blown fuse, low voltage, worn bearings or an overload. Where none of these faults is found, check for loose rotor bars, as already explained, or stator coils that appear to have been overheated. The latter condition would indicate a short in a coil or group of coils. If bars and coils are satisfactory, check the winding with low voltage d-c and a compass, as previously explained, for reversed coil, coil group, or phase connections.

Should the motor take abnormally long to reach full speed, the trouble may be due to defective controller contacts, loose wiring connections, overload on the motor, or loose rotor bars.

Overheating

Excessive temperature may result from a blown fuse, poor wiring connections or controller contacts, under- or over-voltage, considerably unbalanced motor terminal voltages, motor overload, or loose rotor bars. A short-circuit or ground in the stator winding can also be responsible.

Motor overheating can also be caused by dust in the windings or on the outside of the motor, preventing circulation of air and radiation of heat. Both inside and outside of the motors should be kept free of dust at all times with dry, medium pressure compressed air or a portable blower. If only the bearings of the motor overheat, inadequate lubrication, excessive belt tension or end thrust, or misalignment of the bearing of the motor may be responsible. In ring-oiled bearings, the oil ring may not be rotating, the oil level may be too low, or a wrong type of oil may be in use. Where ball or roller bearings are employed, there may be an excessive quantity of grease in the bearing, or a rotating part of the bearing may be damaged.

Sometimes, where the motor has recently been disassembled, the cooling fan will have been reversed.

Motor hum may result from an uneven air gap which can be checked with a feeler gage. If the gap is too small at the bottom, bearing wear is indicated and replacement is necessary. Humming may also be caused by an unbalanced rotor.

Motor Vibration

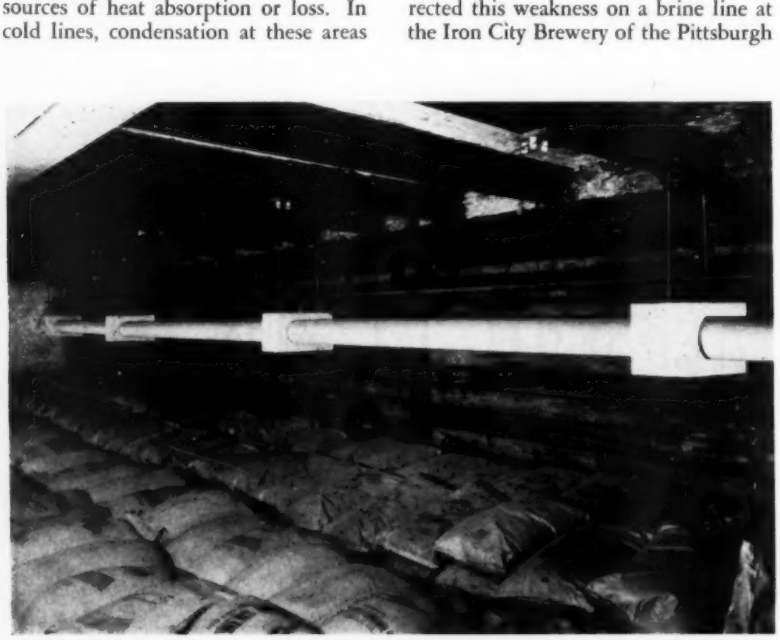
Vibration occurring after recent repairs may be due to misalignment of the motor or coupling, driven equipment out of balance, bearing misalignment, excessive end play, loose motor fastening, or broken ball in ball bearing. Other causes are rotor out of balance due to installation of new coils, shifting of fans or weights, or drilling of holes in the metal. Before disassembly, a motor, its coupling and the motor's location should be checked and a sketch made of the various measurements. This will insure proper assembly and save time.

Any noise developing in a motor should be checked promptly to determine its cause before serious damage develops. Loose rotor bars, bent fan or loose motor fastenings are some of the possible sources.

New Technique Insulates Pipe Hangers

• An all-too-frequent weakness in otherwise carefully insulated pipe lines is the succession of gaps at pipe-hangers where exposed pipe surfaces are sources of heat absorption or loss. In cold lines, condensation at these areas may cause moisture to creep under the insulation and, by wetting, result in even more unnecessary heat absorption.

Unique boxes have successfully corrected this weakness on a brine line at the Iron City Brewery of the Pittsburgh Brewing Co. The new technique prevents brine, at 24 F, from absorbing heat at hanger points and eliminates destructive moisture condensation.



Hanger connections at pipes are inclosed in boxes made of 3-in. thick mineral wool boards, filled with loose mineral wool and sealed, to stop heat loss at supports

Each insulating box is formed by cutting 3-in. thick mineral wool boards to fit around existing pipe insulation and the pipe hanger. The boards are fitted together and fastened with skewers, and loose mineral wool is packed inside to a density of 9 lb per cu ft. The boxes (four are visible in the photo) are vapor sealed with wax-impregnated fabric and rosin-sized paper, and finally finished with an 8-oz canvas jacket.

The piping itself, running from brine tank to stock house, is insulated with 3-in. thick molded-type mineral wool pipe insulation. The insulation is applied in two 1½-in. thick layers. Tightly spiraled jute twine presses the first layer into a thick coat of asphalt mastic trowelled onto the pipe surface. The second layer is similarly secured over mastic on the first layer, and the insulation is finished like the boxes.

This insulating technique can be adapted to heated lines carrying steam, petroleum derivatives or industrial chemicals as well as cold lines.

Courtesy of the Industrial Mineral Wool Institute.

OXYGEN AND CARBON-DIOXIDE CORROSION

Here is the inside theory behind the corrosive ability of the two most troublesome gases encountered in the feedwater cycle. Study these facts and diagrams so you know how to select treatment that will protect boilers and return lines

PAUL BRINDISI,
Chemical Engineer,
Celco Laboratories

NATURAL WATERS contain dissolved oxygen and carbon dioxide, oxygen being found mostly in surface waters and carbon dioxide in underground supplies. Neither gas is of a corrosive nature, but is rendered so by the presence of water.

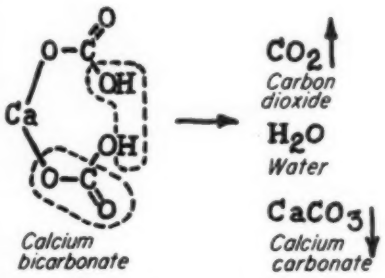


Fig. 1 — Bicarbonates break down into carbonates and CO_2 gas when heated

Hence, corrosion will not take place in dry steam spaces, but is very apt to occur in the feedwater system, the boiler and in wet-steam and condensate lines. Oxygen is the more active of the two and together they are highly destructive. The release of these gases from solution is speeded up by heat.

The only available oxygen is that dissolved as a gas, whereas carbon dioxide not only exists in the free state but is given off from the water's natural bicarbonate content breaking down when heated in the boiler, Fig. 1.

Oxygen attack shows up as pit holes,

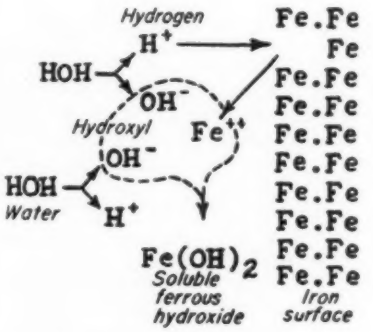


Fig. 2—Water breaks up into hydrogen and hydroxyl ions to a limited extent

which are likely to appear in the generating tubes and along the water-level belt of the boiler. Carbon dioxide attack appears as grooves and a thinning out of the metal, the latter usually occurring first at pipe threads in the condensate system.

Because it is able to break up to a limited extent into hydrogen and hydroxyl ions, Fig. 2, water is capable of dissolving some of the metal it contacts. Through electrochemical reaction a little of the iron leaves the metal body to replace the less active hydrogen that disengages itself from the main water mass. But the water's exceedingly low capacity for dissolving the displaced iron together with the hydrogen's protective film, which develops on the affected metal surface, both curtail continued exchange. The iron thus consumed would be infinitesimal were it not for the presence of free oxygen.

Oxygen Reaction

Oxygen combines with the protecting hydrogen to form water, which re-exposes the metal surface, Fig 3. Simultaneously, the iron taken into solution is oxidized and precipitated out as rust, enabling the water to redissolve additional displaced iron. With a constant replenishment of oxygen by fresh water, deterioration of the metal wall progresses until a repture develops.

Since water dissociates into like quantities of strong acidic hydrogen ions and the equally strong alkaline hydroxyl ions, it is chemically in balance and therefore perfectly neutral. But carbon-dioxide gas dissolving in water converts the strong alkaline hydroxyl ions into weak alkaline bicarbonate ions, leaving the strong acidic hydrogen ion unaffected, Fig. 4.

The presence of a goodly portion of alkaline salts, normally in natural waters, tends to greatly counteract acidity imparted by the dissolving carbon dioxide, so that generally, it does not have too serious an affect on the raw water.

With pure condensate, however, the degree of its acidity depends on the amount of carbon-dioxide gas escaping with the steam. Here, the only neutralization possible is that effected by a small stream of alkaline ammonia gas which may be released in the boiler by

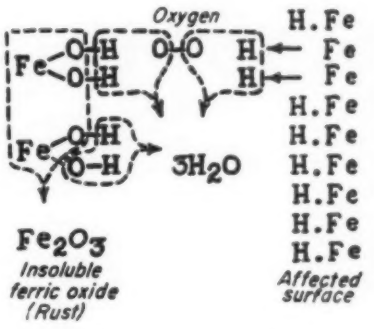


Fig. 3—Hydrogen protects iron, but it also combines with the attacking oxygen

breakdown of nitrogenous organic compounds (commonly contaminating natural waters) in the boiler. The acidic influence of carbon dioxide renders the condensate corrosive.

Inasmuch as the only source of available oxygen is the dissolved gas, it can be eliminated from the boiler system mechanically and chemically. Since oxygen, tending to remain in solution, decreases with a rise in temperature, the extent to which the gas is mechanically removed relies upon how near to boiling the feedwater can be preheated.

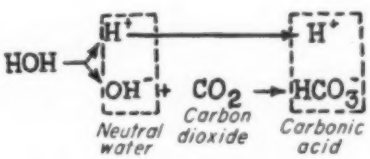


Fig. 4—Hydroxyl ions and CO_2 combine to form carbonates and free hydrogen

With a modern-type deaerating heater, wherein the finely dispersed water comes in intimate contact with live steam, the feedwater can be held at the

boiling point, so practically all the dissolved oxygen is expelled. The effectiveness of an open heater using exhaust steam is considerably less.

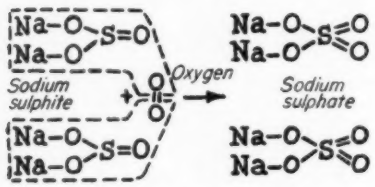


Fig. 5—Sodium sulfite reacts with oxygen to form the soluble sodium sulfate

Because closed heaters or economizers cannot be vented, they are severely attacked by oxygen gas. Where the initial expenditure for installing an open heater or a deaerator cannot be justified, the receiving tank can be converted into a crude open heater by inserting a perforated steam coil along the bottom and providing thermostatic control.

Mechanically ridding the feedwater of the greater portion of its dissolved oxygen content minimizes the amount of follow-up chemical treatment required, and lowers the boiler water total-solids content. This means less blowdown.

Treating the preheated feedwater with chemicals such as sodium sulfite renders the residual dissolved oxygen inactive and forestalls its possible escape in the boiler. Sodium sulfite reacts with the oxygen to form the soluble salt sodium sulfate, Fig. 5.

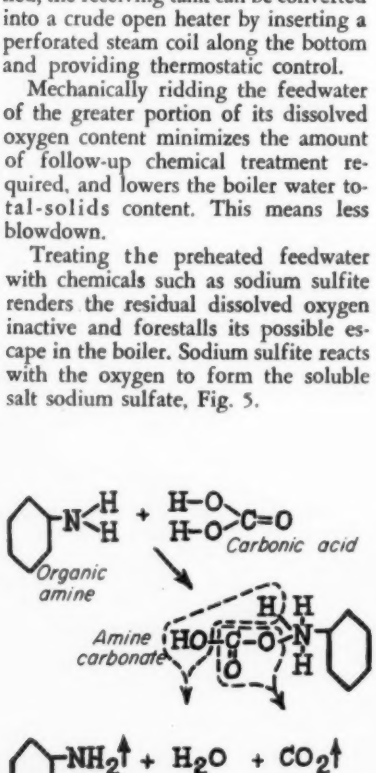


Fig. 6—Amines volatilize with steam and combine with CO_2 to prevent corrosion

The commercial grade of sodium sulfite contributes alkalinity that is a disadvantage where the boiler water total-alkalinity concentration needs close control. Under such conditions organic colloids, which also help coagulate the sludge, can be used. Carrying an adequate excess of sulfite in the boiler water maintains the boiler unit and its after-system oxygen-free.

As reaction between sulfite and oxygen is not instantaneous the chemical corrective is best fed continuously to the storage compartment of the heater or through the suction side of the feed pump. With an economizer, continuous feed becomes a necessity.

Pure magnesium or zinc bars suspended in the boiler water provide some protection because of the superior activity of these metals over iron, hence, their greater willingness to enter into electrochemical reaction with the dissociated hydrogen of the water.

In so doing, they afford, within certain limits, the iron of the boiler proper immunity from the ensuing oxygen attack. The practicability of this scheme, however, is limited to low capacity, horizontal firetube boilers.

Various highly reactive chromium compounds are capable of oxidizing the uppermost layer of iron, and the impermeable, hard, protective coating thereby formed renders it passive to corrosion. But the exceptionally high concentrations required to produce a satisfactory result are hardly tolerable in low-pressure boilers and the cost for their maintenance is usually high.

Oxygen Escapes

Then, too, this method of safeguarding the boiler metal permits the dissolved oxygen to escape with the steam and increases the corrosiveness of the condensate. Furthermore, these chemicals are poisonous, necessitating careful handling by plant operators.

Although this corrosion-inhibiting method has been sparingly applied to steam-generating units, it rightfully finds greater use in treating recirculating cooling-water systems where the relatively lower degrees of blowdown, chemical concentration, temperature and pressure are more favorable. The method is also adaptable to brine systems.

Liquid silicious compounds are occasionally introduced into condensate return lines to coat the system with a glassy, protective silicate film. Rather than a continuous coating, this method frequently develops a series of irregular, patchy deposits. In addition, it cannot be controlled accurately either visibly or chemically.

Another difficulty is that the silicate invariably reaches the boiler where it accumulates, and eventually precipitates calcium and magnesium hardness as a tough, extremely adherent scale. This method of treatment, nevertheless, does give good results in hot-water systems.

Certain soluble, complex phosphate compounds possessing similar surface-active qualities are sometimes employed to prevent corrosion in exceptionally long feedwater lines. They are particularly helpful in zeolite-softener effluent containing no calcium bicarbonate, which ordinarily deposits a protective carbonate film. The feedwater line and economizer can also be protected against corrosion by recirculating a small amount of alkaline boiler water.

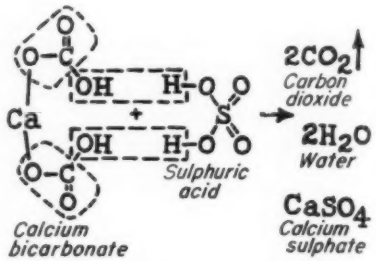


Fig. 7—Acid treatment changes bicarbonates to sulfates and liberates CO_2

Expulsion of free carbon dioxide in good deaerator operation, in conjunction with the complete elimination of dissolved oxygen (mechanically and chemically) produces a feedwater that is practically gas-free. Any corrosive gas escaping with the steam will be principally carbon dioxide released from natural bicarbonate that undergoes decomposition within the boiler.

The released carbon-dioxide gas is prevented from becoming active by the boiler-water alkalinity. Thus, the boiler is fairly safe from corrosion and the corrosiveness of the condensate is minimized.

Several soluble organic amines, compounds that have the alkaline ammonia stem as their reactive component, are capable of volatilizing with the steam

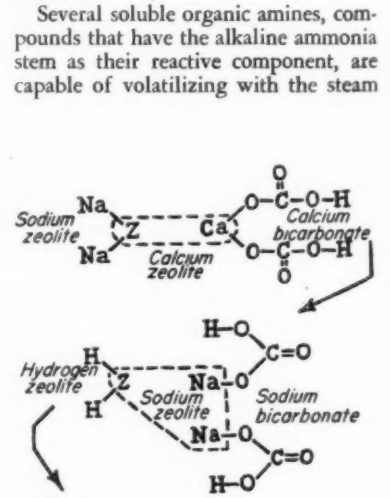


Fig. 8—Sodium- and hydrogen-regenerated zeolites hooked-up with aeration

and neutralizing entrained carbon-dioxide gas, Fig. 6. The resulting neutral product, however, decomposes into its original gaseous amine and carbon-dioxide constituents when the condensate reaches the feedwater heater.

The inability to recover these amines makes this method fairly expensive unless the carbon dioxide has been reduced considerably by acid treatment of the feedwater. Other similar chemicals have been advanced as capable of lining the condensate-return system with a uniform, continuous, protective film, but, as with the silicate treatment, they generally leave patchy deposits.

With acid treatment the feedwater bicarbonate content is changed to sulfate and the carbon dioxide liberated, Fig. 7. The free gas can be expelled by aeration. The feedwater bicarbonate should not be destroyed completely, else the system will become subjected to severe acid attack. After adding the acid, the water can be circulated through a baffled retention chamber and compressed air rapidly bubbled from the floor network, or a miniature forced-draft cascade tower can be employed for this purpose.

Deaeration must, of course, still follow to insure having the feedwater near-oxygen-free as well. To safeguard feedwater lines, their accessories and the economizer from an acidity-induced corrosion, acid-treated feedwater should be rendered slightly alkaline with caustic soda. This compound neither decomposes nor is it gas-forming. Recirculating a small amount of the more-alkaline boiler water also helps.

Steam completely free of carbon dioxide can be had by softening the raw water in a combined sodium- and hydrogen-zeolite system. In the common sodium-zeolite procedure, the sodium of the softener medium replaces the calcium and magnesium.

The softener bed thus becomes converted to calcium and magnesium zeolite while the sodium forms of the salts proceed on. Among these will be sodium bicarbonate which readily breaks down in the boiler and releases its carbon dioxide. By also passing the water through hydrogen zeolite the sodium salts are, in turn, displaced by hydrogen, Fig. 8.

The resulting carbonic acid easily decomposes and its carbon dioxide is entirely eliminated by aerating the softener effluent. The beds are reverted to their original forms by regenerating the medium of the first softener unit with sodium chloride and that of the second with sulfuric acid.

A feedwater virtually free of all contamination, either saline or gaseous can be so obtained. Economical and practical considerations, however, often dictate that only a partial treatment with hydrogen zeolite is adequate.

First Unit in the Missouri Basin Project

• Principal features of the Kortes Dam, Kortes, Wyoming, one of the units in the Missouri Basin Project, are a concrete gravity dam across the North Platte River, and an uncontrolled curved spillway located at the right abutment. The spillway will discharge into a 30-ft diameter, 475-ft concrete-lined spillway tunnel.

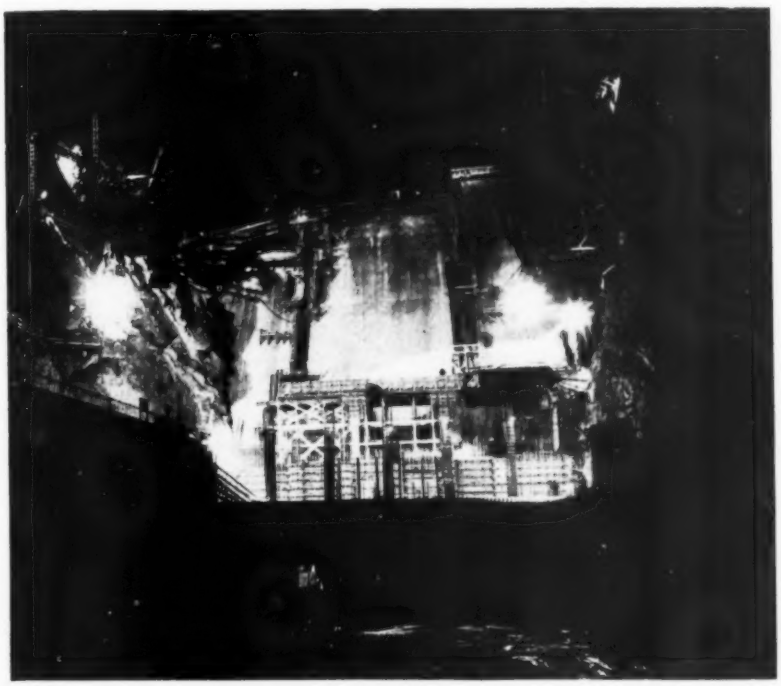
About 440 ft long at the crest, the dam has maximum height of 240 ft above the river bed. The foundation rock was drilled and solidified by shallow grouting, and a main grout cut-off curtain was formed by drilling holes into the foundation rock and filling them by high-pressure grouting. Foundation drainage is provided by a series of drilled holes discharging into drainage and grouting galleries.

Concrete of the dam is divided into blocks or columns by means of vertical transverse contraction joints. Systems of grout pipes are embedded in the mass concrete with outlets into the contraction joints by means of which these joints are pressure grouted after the concrete cools. A system of pipes, installed in the concrete of the dam, circulates water to cool the concrete artificially.

Three 108-in. diameter power penstocks are embedded in the dam. Penstock entrances on the upstream face are protected by individual trashracks and can be closed by individual coaster gates on the dam face. A gantry crane on top of the dam provides the means for operating the coaster gates.

The power plant, of reinforced concrete construction, will be located at the toe of the dam, with the switchyard on its roof. The plant will accommodate three main generating units, each consisting of a 12,000-kw vertical-shaft generator with a direct-connected main exciter, driven by an 18,500-hp turbine.

During construction, the river is diverted through a temporary tunnel in the right abutment. Upon completion of the dam this tunnel will be closed.



Floodlighting plays important part in around-the-clock construction. Providing proper illumination is lighting engineer's job. Courtesy, General Electric Co.

DIFFERENTIAL PRESSURE CONTROLS AMMONIA LEVEL

Principles and applications of an oil operated float control for low- and high-pressure ammonia systems will give refrigeration engineers a good insight to a practicable temperature control having good operating efficiency. Here you learn how this simple device can be installed, and how it functions to hold conditions

A. W. RUFF, *Consulting Engineer*
V. C. Patterson & Associates Inc.

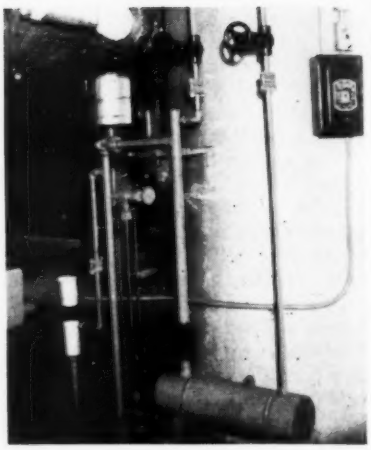


Fig. 2—Remote control assembly can be located away from the evaporator unit

FULL AUTOMATIC control of liquid refrigerant in large ammonia refrigerating plants has always been a seemingly difficult problem. Application of low-pressure float valves has been generally accepted, because this method is positive and reliable when properly applied. The main objections are difficulty of maintenance and service since they are usually insulated. In case of mechanical trouble, there is a troublesome overhaul problem. In addition, in extremely low-temperature work, oil in the refrigerant has a tendency to cause sluggish action or clogging of the mechanism. A further problem is leakage, which might occur since they are not tight closing.

These problems, plus the importance of a visual record of actual liquid-level conditions, set up the need for a device free of oil and frost problems that provides a means of continually showing the exact conditions. A liquid-level indicator and controller has been actually developed in the field to correct these and other operating difficulties. It has been applied satisfactorily to many duties in all types of ammonia refrigerating plants.

In a typical installation, Fig. 1, the indicating and controlling device is located remotely from the low-pressure refrigerant tank or shell and connected by two pipes. This unit has an oil reservoir and oil gage column. Oil rises in this column and gage glass and not only indicates a level but also can actuate a float switch, or switches, to operate control equipment.

Difference in pressure is established by the liquid level in the shell and shows an exact value or elevation in the gage column. This pressure differential is produced in the following manner:

1. A gas line is connected between the top of the low pressure surge drum and the top of the oil column. This line carries only gas and contains valve (A).

2. The second connecting line is taken off the surge drum, at a position considerably below the desired liquid level. This line leads to the oil reservoir through valve (B), and pressure is exerted on top of the oil column. The line is connected into the surge drum so there is a short evaporating or energizing section. The liquid ammonia continually surges and produces gas, which bubbles into the surge drum, as the oil pot acts as a seal and the gas cannot move in that direction.

The pressure on this liquid line is greater than the gas line. The difference is equal to the liquid ammonia head against which the bubbles of gas must be forced out. Valve (C) is closed during normal operations. The pressure differential is registered in the gage glass and shows up in the oil column.

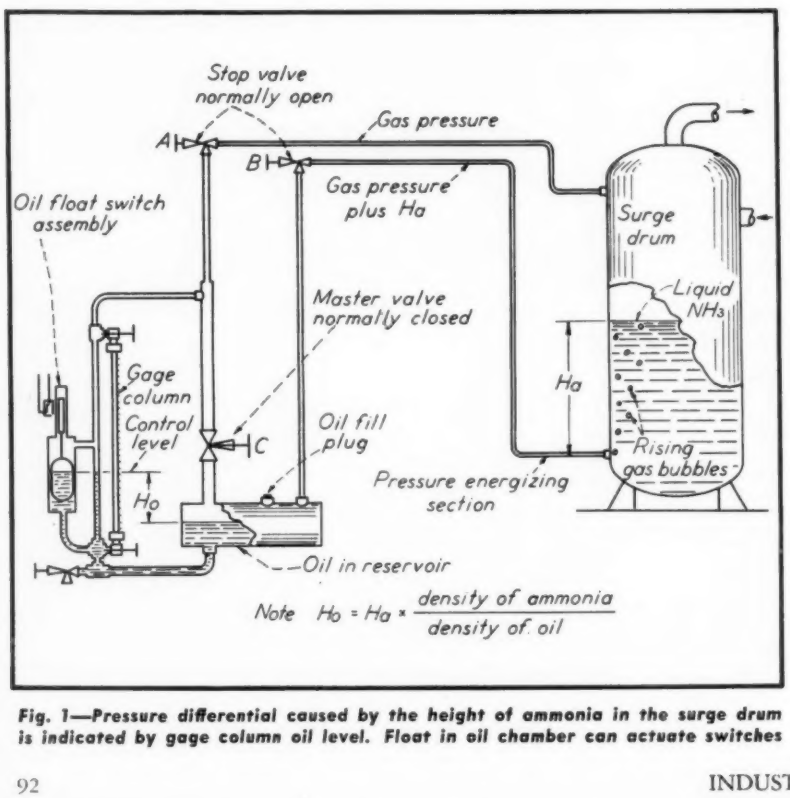


Fig. 1—Pressure differential caused by the height of ammonia in the surge drum is indicated by gage column oil level. Float in oil chamber can actuate switches

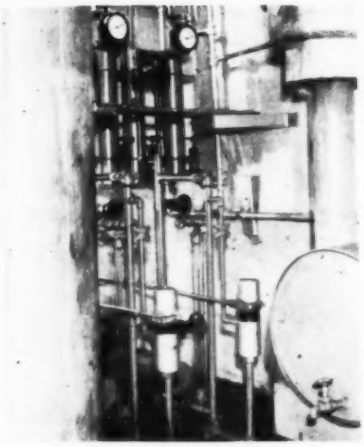


Fig. 3—Evaporator liquid level is observed in indicator three floors below

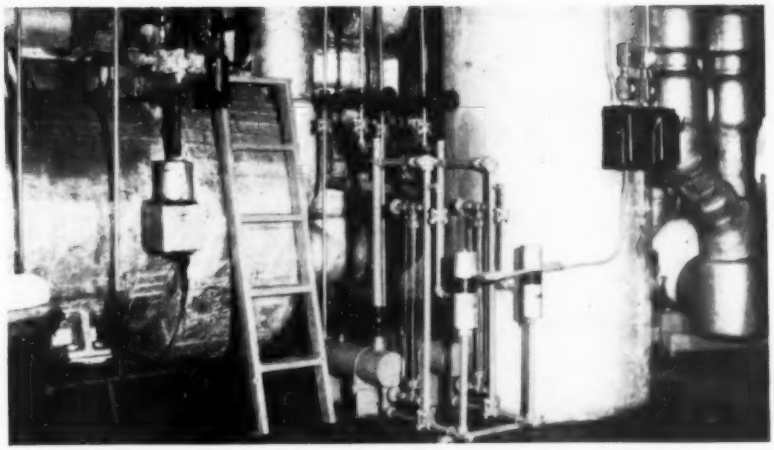


Fig. 4— Two liquid level indicators, one for each refrigerant pass, control the amount of ammonia metered to this two-section low-temperature brine evaporator

Frost appears only on the horizontal energizing section of the pipe. This pipeline must be in an ambient temperature warmer than the liquid refrigerant so as to assure gas generation. In some cases it has been necessary to use artificial heat to assure action. Both interconnecting pipe lines must slope slightly from the highest point near the liquid level indicator so as to return any condensed liquid refrigerant to the container or low-pressure surge drum. This will only occur during abnormal conditions such as hot gas defrosting.

Valve (C) can be opened to check the normal or equalized oil level in the oil pot and reservoir, but must be closed for normal operation. However, valve (C) must be open when operating valves (A) and (B) to avoid losing the oil from the pot. If valve (C) is closed and valve (A) opened before (B), a higher pressure in the oil pot will force the charge of oil out through (A). If (C) is closed, open (B) first.

In normal operation, there is no gas flow through connection (A) or (B).

There is a wide diversity of applications and each system can be electrically tied into the over-all plant control. Best performance has been in cold-storage, food-freezing, dairy and ice-cream plants. In many cases the control has been installed in existing plants to overcome difficulties, or as a part of modernization.

In summation here are the advantages of this type of control:

1. Installation cost is often less than a low-pressure-float combination.

2. Control is fully automatic and positive. By cutting into an electric solenoid liquid valve circuit, liquid feed can be automatically shut off when the compressor is stopped. This prevents overfeeding during shutdown.

3. Visual record of the liquid level shown on the oil-gage column keeps the operator informed at all times.

4. Control can be remotely located from the evaporator and so placed for most convenient observation.

5. Controlled liquid refrigerant level can be changed by adjusting the oil float position in the oil column without opening the refrigerant piping or pumping down the system.

6. It reduces over-all operating costs and gives more efficient performance.

7. Normal operation is safer, and the controls can be tied into other safety and warning devices such as warning bells and signal lights.

8. It reduces operating labor and attention from maintenance men.

9. Unit is compact and it easily can be mounted on a wall or floor with brackets. Space required is approximately 50 in. high, 40 in. wide and 7 in. in depth.

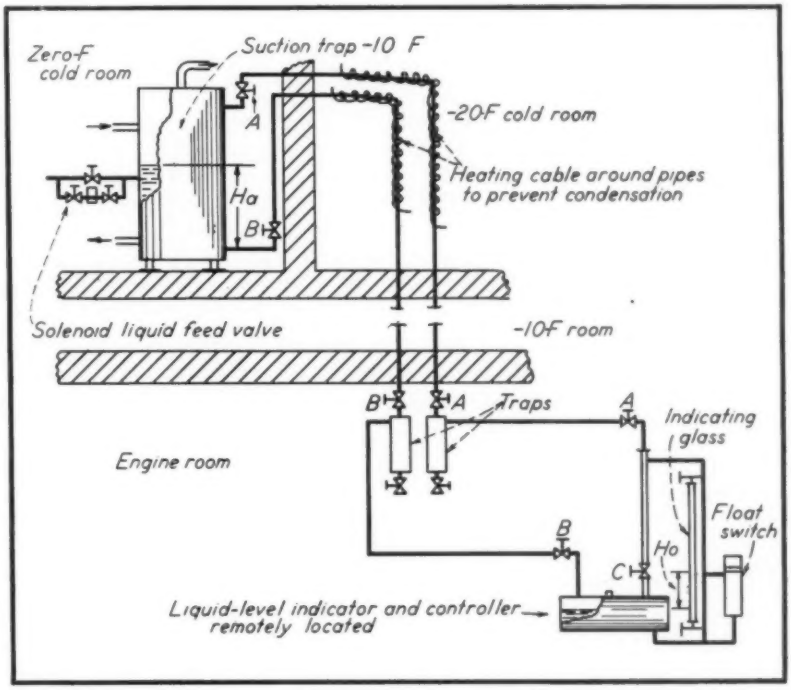


Fig. 5—For efficient operation pipelines must slope from the surge drum to the liquid-level indicator. If subjected to extreme cold the line should be heated

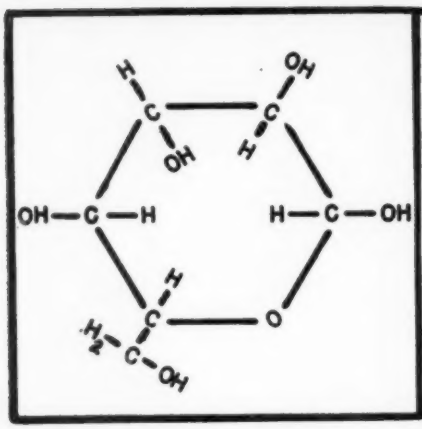


Fig. 1—Half of a wood crystal cell consists of a pure or complex alpha-cellulose molecule

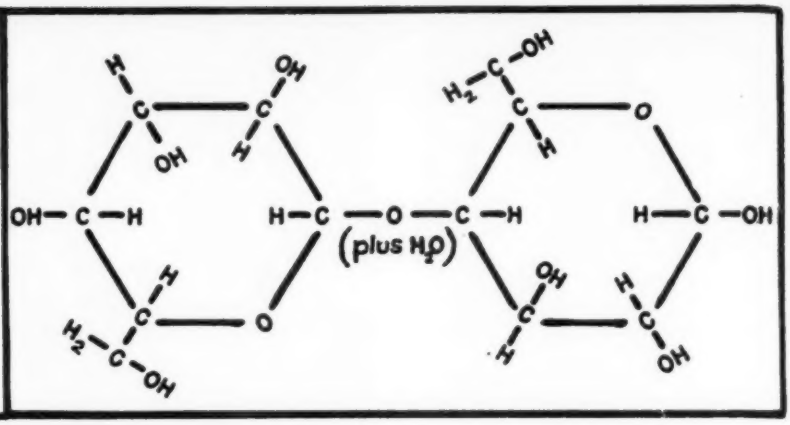


Fig. 2—Joining two glucose molecules with one oxygen molecule from water is natures way of manufacturing cellulose. Reversal of the process will produce sugar under extreme conditions

Fundamental Principles Leading to an Understanding of Wood Deterioration

Deterioration of wood in cooling towers has brought forth numerous research projects that were started to find the real cause of this destruction. Results indicated that plant growths, such as fungi and mosses, changed the physical and chemical structure

D. R. BAKER, *Research Engineer*
The Marley Co., Inc.

WOOD DETERIORATION, called delignification, produces a white, fibrous condition on the surface of lumber in cooling towers. It is the result of a pulping process, similar to that used in the manufacture of paper, and is caused by removal of the lignin that binds cellulose fibers together. Another type of deterioration caused by fungi has recently been observed that attacks the inside rather than the outside of wood in a cooling tower.

Instances of attack are few but serious enough to warrant investigation, so the problem was presented to a number of authorities, including the Forest Products Laboratory at Madison, Wisconsin, which is a part of the Forest Service of the U. S. Department of Agriculture. The services of this agency have been obtained to study the problem through a series of co-operative agreements, and this program is still in progress.

Investigations have disclosed a vast amount of information available regarding wood, its products and uses; but little is known about application for cooling towers although it is the most common construction material. Cool-

TABLE 1—PRINCIPAL COMPONENTS OF THE PLANT KINGDOM

SPORE BEARING OR CRYPTOGRAMS

I. Thallophytes—fungi, mold, algae, bacteria, lichens.
   A. Bacteria—attack cellulose.
   B. Filamentous Fungi, Molds — decompose cellulose in soils, many kinds exist. Attack various parts of plant. Nitrogen influences decomposition.
   C. Fleshy Fungi—most important in wood decay.

II. Bryophytes—liver worts and true mosses.

III. Pteridophytes—ferns, club mosses, horsetail, rushes. (First Fibers)

SEEDS OR PHANEROGAMS

IV. Spermatophytes—flowering plants.
   A. Gymnosperms—naked seeds, 650 species.
      1. Cycadales.
      2. Ginkgoales.
      3. Coniferales—softwood lumber.
      4. Gnetales.
   B. Angiosperms (150,000 species)—seed in fruit.
      1. Monocotyledons—palms, bamboo, grass. Endogens—stalk, hair fibers in pith.
      2. Dictoyledon—all others.

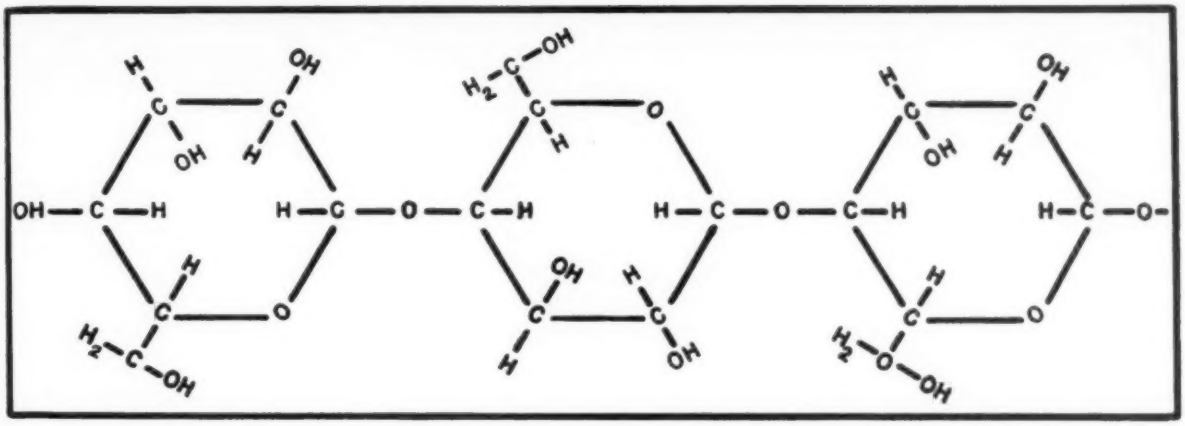


Fig. 3—Alpha-cellulose is defined as that part of the extractive-free wood that is insoluble in a 17.5 per cent solution of NAOH at 20C. However, cellulose becomes soluble if first treated with a 10-normal NaOH and then diluted to 3-normal and also concentrated acids

ing towers are exposed to an atmosphere of warm, humid air, and a complete range of moisture conditions varying from water-flooded to completely dry. Temperature range is moderate, but it includes the optimum growing conditions for wood-destroying organisms. All metals must be corrosion-resistant or must be covered with a protective coating to prevent oxidation and corrosion.

In testing protective coatings, specimens exposed in a cooling tower fail sooner than when undergoing so-called accelerated immersion tests using acids, bases and salt solutions. Severity of these conditions should lead to expected wood deterioration. But, deterioration is the exception rather than the rule.

Cooling Tower Wood

Wood durability adds to its importance in many industrial applications. It will withstand a wide range of hot or cold neutral salts, dilute acids or alkalies, and 5% HCl, 20% H_2SO_4 and dilute organic acids can be handled. Manufacture of tanks is possible because of resistance to chemical attack. Species for this purpose are selected because of durability and impermeability and include cypress, redwood, douglas fir, southern pine, larch and white oak. Wood employed in cooling towers must be durable under the conditions encountered, be able to withstand alternate wetting and drying without developing structural defects, have sufficient structural strength, and be commercially available in required sizes and grades.

Wood adaptability in cooling towers is well illustrated by the fact that circulating water is treated to prevent scale formation in heat exchangers and to protect the metals against corrosion. However, no thought is given to the protection of wood execpt in rare instances and then only by painting.

Wood deterioration may result from a chemical or biological attack. The resistance offered, however, is caused by the chemical composition and the peculiar structural arrangement that result from the wood's manner of growth. Decay has been found in cooling towers constructed of both redwood and cypress. Furthermore, decay is not confined to any one make or type or location. Attacks have been found in atmospheric deck towers, forced draft and conventional induced draft towers and in double flow towers.

In one instance a decayed board was found in the top deck of a cooling tower after three years' operation, but in the majority of cases this occurs in towers 5 to 7 years old. Certain parts of the structure are more susceptible than others. These include—drift eliminators and supports, inside casing of forced draft towers, structural members between eliminators and top fan deck of induced draft towers, structural members just below the eliminators of forced draft towers, cell partitions and top fan decking—all of which need protection.

Rather definite patterns seem to be followed in each case and will be confined to some particular part of the tower. The problem is so new that little research has been done to determine the exact nature of deterioration in cooling towers. No quick or easy solutions are evident so the best approach to the problem seems to be through a general study of wood characteristics, durability in similar environments and known patterns of deterioration.

Plant Kingdom Divisions

General divisions of the plant kingdom are shown in Table I. The first three groups comprise those propagated by spores of which Group I contains the wood-destroying organisms. Lumber producing plants fall in two of the classes in Group IV. The angiosperms are the dominant plants of the present time and the "hardwoods" make up a small part of these. The structure of hardwoods becomes more complex during cell structure development.

Structural properties and durability of wood results from the manner of growth and the peculiar methods adopted by nature combining the various wood components. The most obvious wood characteristic is the formation of concentric layers around the center of

TABLE 2—CHEMICAL AND EXTRANEOUS CONSTITUENTS OF WOOD

I. Cell Wall
- A. Carbohydrates (72%)*
  - 1. Cellulose (49-50%) $(C_6H_{10}O_5)x$
  - 2. Hemi-cellulose (23-26%)
    - a. Pentosans ($C_5H_8O_4$)
      - (1) Xylans
      - (2) Arabans
    - b. Hexosans ($C_6H_{10}O_5$)
      - (1) Mannans
      - (2) Glucosans
      - (3) Galactans
    - c. Uronic acids
- B. Lignin (24-29%)

II. Extraneous Matter
- A. Volatile oils and resin acids (essential oils, strong fragrant odors), volatile acids.
- B. Fixed oils (fatty oils). Non-volatile.
- C. Natural dyestuffs and precursors.
- D. Tannins.
- E. Polysaccharides and glucosides.
- F. Ash (mineral salts).
- G. Organic nitrogen compounds.
- H. Other organic compounds—like resenes, and phytoserols.

* All percentages shown are of the dry cell wall material.

the bole. Tree growth is actually a series of biological developments, which occur at specific periods during the growing season. The first seasonal growth is elongation, which occurs in the branches and roots. This is followed later by an increase in diameter of other tree parts, and this part of the growth produces lumber.

Each annual layer is composed of two rather distinct zones, the first formed is called spring wood while the darker and denser wood, formed later in the season, is called the summer wood. A further examination of a tree cross-section will show that the sapwood, which is located next to the bark, is of a lighter color than the center heartwood. Actual growth of bark and wood occurs in the cambium layer. This is a zone one cell thick separating the bark and wood and completely encasing branches and roots.

Cells composing the cambium are identical with those on either side, but they are the only ones capable of reproduction. Cells consist of a long spindle-shaped mass of protoplasm completely encased. Wood reproduction is accomplished by the simple process of division. The vast majority of cells have axes parallel to the center of the tree, but a few point radially towards the center. The axis of the newly formed cell is always parallel to the older cell. The division may be made so that the old cell moves either outward to form a part of the bark, or inward to form a part of the wood of the bole.

Principal components of wood are shown in Table 2, but the composition of the cell wall is probably far more complex than indicated. Approximately half of the cell wall consists of pure or alpha-cellulose. Aside from the extractives, the balance of components is about equally divided between hemi-cellulose and lignin, as indicated in Table 3.

Wood Constituents

Chemical composition of the components is quite complex. More is probably known about cellulose than most of the others. The close relationship between glucose and cellulose is shown in Fig. 1. The diagrams are not meant to infer that these are the steps followed by nature in manufacturing cellulose from glucose, although that transformation is accomplished by the cells. The process may also be reversed and cellulose hydrolyzed with difficulty to produce sugar.

Various procedures followed in analyzing wood actually destroy or alter some of the components. Many industrial processes such as pulping in the manufacture of paper utilize strong solutions, usually in conjunction with heat or pressure, in order to obtain rapid reaction. Considerable information is available regarding these processes and some of it is applicable to the study of wood deterioration in cooling towers, although the conditions promoting chemical deterioration will be less severe. Little research work has been done on the effect of dilute solutions such as are present in circulating systems, but many of them can react with the wood so their possible effect over long periods of exposure must not be overlooked.

Dilute acids will convert hemi-cellulose into sugars by hydrolysis, and will not readily rupture the oxygen linkage in the cellulose molecule degrading it into compounds that may be hydrolyzed to glucose. Chlorine not only removes the hemi-cellulose but combines with lignin to form lignone chloride. Alkalies will dissolve lignin and strong alkaline solutions change the chemical structure of cellulose by hydration. The latter results in a decrease in density and is called "mercerizing".

Sodium hydroxide causes a swelling of the cellulose fibers, increasing the permeability across the grain. The extractives are removed by various solvents so they are subject to leaching by the circulating water. Their removal causes the wood to lose the special properties imparted by the extractives, and durable woods can be subject to decay.

Commercial Processing

Pulping, or delignification, is probably the most important commercial process dealing with the chemical decomposition of wood. This process removes lignin, pectins and resins from the unbroken or partially disrupted cellulose. Table 4 contains a summary of the various pulping agents. It should be understood that no process will remove any one constituent with out altering or attacking some of the others.

The ideal pulping agent would remove all of the undesirable constituents such as the lignin and extraneous matter, possibly have little effect on the hemicellulose and not attack the cellulose. Such a process does not exist, and removing undesirable components without degrading the cellulose is impossible. Commercial operations are always a compromise between a high quality and low yield; or a low quality and high yield of pulp.

Nitric acid delignifies wood by a combination of nitraton, oxidation and hydrolysis. Alkaline salts produce delignification while neutral salts at high temperature and pressures act as acids to degrade cellulose. All oxidizing agents attack lignin. Drying of alkali-impregnated wood is serious because of the swelling action of alkali on cellulose, and because it promotes oxidation. Drying wood impregnated with mineral acids, or salts that hydrolyze to acids, makes wood brittle because of the formation of hydro-cellulose.

Destruction of wood by biological attack may, like chemical deterioration, serve a useful purpose or it may be undesirable. The digestive process of

TABLE 3—CHEMICAL COMPOSITION OF WOOD

	Cellulose	*Lignin*	*Wood (less extractives)*
Carbon	44.4	63.0	49.0
Hydrogen	6.2	6.0	6.0
Oxygen	49.2	31.0	44.0

TABLE 4—COMPILATION OF PULPING AGENTS AND THEIR REACTIONS

Process	*Reagents*	*Remarks*
Sulfite	Calcium or magnesium bisulfite plus sulphuric acid	Render lignin soluble. Hydrolyzes hemi-cellulose. Degrades cellulose. Reacts with extractives.
Alkaline or Soda	Sodium hydroxide	Usually used on hardwoods. Dissolves or renders lignin and hemi-cellulose soluble.
Sulfate or Kraft	Sodium sulfide or sulfate plus sodium hydroxide	A modification of above.
Chlorination	Chlorine	Bleaching of pulp to complete delignification and remove coloring.
Neutral	Sodium sulfite	Not used commercially, but less active than NaOH. Gives better yield by suppressing hydrolysis.
Misc.	Sodium carbonate	
	Sodium bicarbonate Sodium thiosulfate	Poor because they decrease yield of alpha-cellulose.
	Sodium phosphate	

some animals, sewage disposal and formation of coal are all results of biological decomposition of wood or related carbohydrates. All of the three classes of organisms listed under Group I of the plant kingdom are shown in Table I.

Cellulose Decomposition

Bacteria will attack sugars, starches and some forms of cellulose; but it is doubtful if any of them decompose wood. The simple fungi, or molds, decompose cellulose in soils and composts and attack various parts of living plants and decompose hemi-cellulose, especially in partially decayed woods. The fleshy fungi are the true wood destroyers, and most of them attack cellulose and produce "brown rot". Some species destroy lignin and produce the rarer "white rot".

Fungi will not attack wood that is either too wet or too dry. Fungi require a moisture content in excess of fiber saturation, and 40 to 50 per cent moisture is considered optimum. Decay does not occur in submerged wood, but it has been found in redwood eliminator slats removed from a cooling tower when the moisture content was 265 per cent of the dry weight. Optimum temperature for fungi is between 68 to 86.

DON'T CLIP — DON'T TEAR

WRITE FOR TEAR SHEETS!

Rather than spoil this issue for other readers in your plant, let us supply you with copies or tear sheets of any of the articles for your file. Just drop a line attention of the editors—Preferably on your company's own letterhead.

Cellulose resists most chemical but is readily decomposed by many of the micro-organisms. While fungi are selective in their attack on cellulose or lignin only a small minority prefer the lignin. Fungi will attack pure cellulose, but even those that destroy lignin in wood will not attack isolated lignin. This indicates that lignin serves to protect the cellulose from decay.

Fungi are efficient in utilization of nitrogen and other minerals so there is some question about the effect of the phosphate used in water treatment. Activity is affected by pH value. Alkaline salts seem to favor decomposition, possibly because organic acids formed by the fungi are neutralized. Some fungi are quite sensitive to tannin and other extractives present in wood. The more durable woods such as black locust, cedar, cypress and redwood are rich in volatile oils that are toxic to fungi or contain resins that afford protection.

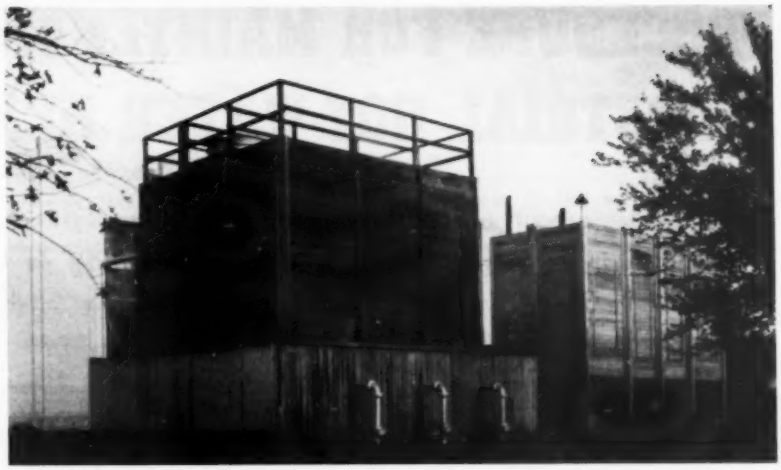


Fig. 4—Fleshy fungi are the true destroyers of wood, and most of these attack cellulose and produce brown rot. Some varieties of fungi attack the lignin cells causing the rarer white rot

Effects of fungus attack is acid hydrolysis followed by oxidation. Rate of degradation of cellulose or lignin depends on the fungus, and cellulose is the part usually attacked. Removal of lignin renders cellulose more digestible by micro-organisms or higher animal life. All lumber is subject to attack when conditions of moisture and temperature are favorable, but the extractives impart natural durability to various species.

Relative Durabilities

Durability of species vary from tree to tree and also in lumber from various parts of the same tree. The relative durability of any variety also varies with the specific conditions of exposure. Table 5 shows "the relative durabilities of heartwood exposed to outdoor conditions". There is no similar comparison available concerning the relative durability of wood used in cooling towers, but the following varieties are used: Redwood, Bald Cypress, Douglas Fir, Western Red Cedar and Southern Pine.

Redwood contains natural extractives that make it highly resistant to decay, and it is by far the most commonly used lumber for cooling towers in this country. The heartwood of bald cypress grown in swamps near salt water, varies in color from slightly reddish to almost black and is called red or tidewater cypress. That grown farther inland is called yellow or white cypress since the heartwood is only slightly reddish to yellowish brown. The slow-grown tidewater cypress is greatly in demand because of its high resistance to decay, but the durability of cypress seems to vary greatly. Douglas fir and western red cedar are used both in this country and abroad. The heartwood of virgin southern pine is highly durable and baltic pine is one of the species used in cooling towers in England.

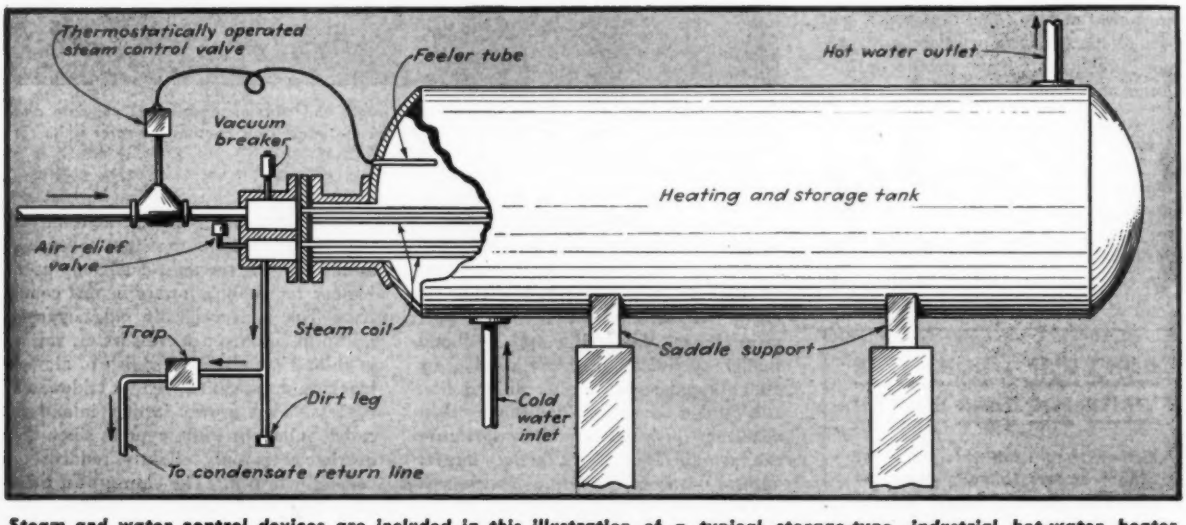
Wood deteriorated by fungi or chemical attack may have a similar appearance, and a miscroscopic examination is often necessary to distinguish between the two. The second and concluding part will cover cooling tower problems.

TABLE 5—BASIC ORDER OF WOOD DURABILITY

1. Osage	12. Chestnut	23. Tulip
2. Black Locust	13. Black Walnut	24. Magnolia
3. Red Juniper	14. Black Cherry	25. Red Oak
4. Bald Cypress	15. Hemlock	26. Sycamore
5. White Cedar	16. Yellow Pine	27. Beech
6. Western Red Cedar	17. Larch	28. Maple
7. Redwood	18. White Pine	29. Popular Elm
8. Incense Cedar	19. Douglas Fir	30. Ash
9. Red Mulberry	20. Elm - Cork, Slippery	31. Birch
10. Catalpa	21. Red Gum	32. Hickory
11. White Oak	22. Black Gum	33. Basswood

PROCEDURE FOR MAINTENANCE OF INDUSTRIAL HOT-WATER HEATERS

Instantaneous and storage-type heaters, supplying hot water for processing operations and plant services, are as important as factory production units. There is every reason to give them top billing on the maintenance program



Steam and water control devices are included in this illustration of a typical storage-type industrial hot-water heater. Thermometers for reading inlet and outlet water temperatures are usually provided at some convenient place in the piping

HOT WATER is of prime importance in all industrial plants, because dependable supplies are required for plant cleanliness, personnel well-being, and many production processes. Consequently, the hot-water heater, which may supply hundreds or even thousands of gallons of water an hour, is equally as important as any production unit in the factory. Because of this fact, its care should have a top position in the maintenance program.

Types of Heaters

Industrial hot-water heaters are usually of two types: instantaneous and storage. Services for which they can be used, as well as recommended water temperatures for these services, are included in one of the Tables.

Instantaneous heaters have little or no storage space; as water is needed, it passes through the heater where its temperature is raised by straight or U-shaped steam coils.

Storage heaters, on the other hand, have a large space for storage of high-temperature water; when needed, the water is drawn from this space.

Steam heating coils in both types are similar, and may be straight or bent, according to heater construction. In general, instantaneous heaters are smaller in diameter and shorter than storage heaters. Maintenance procedures for both types are similar.

Electric hot-water heaters, although used to some extent in certain regions of the country, will not be treated here because their number is relatively small compared to steam-coil heaters.

For simplicity, when discussing maintenance of hot-water heaters, they can be divided into three sections: (1) the water section, which includes tank, piping, valves, gaskets, and waterproofing; (2) the steam section, which includes the heating coils, steam traps, piping, and valves; and (3) the automatic-control section with its steam-flow regulating valve, water-temperature control, and safety devices. This division aids maintenance and inspection. Typical troubles will be discussed.

Water Section

Water-section troubles are usually minor, because the parts involved are not easily broken or subject to improper adjustment. Tank corrosion, accumulation of sludge or organic growths, leaking gaskets, loosened interior coating, corroded relief or check valves, and faulty drains are a few of the most common troubles. These, and others, have been summarized in one of the accompanying tables.

Interior corrosion can be limited by using certain types of steel, copper-lining, or some form of interior coating. Newer heaters are usually lined with a corrosion-resistant metal, while this is not the case with older heaters. Hence, with new heaters, it is only necessary to make an annual inspection of the tank interior to determine the condition of the metal. Sludge accumulations should be removed by weekly blowdowns.

Interior coatings for unlined tanks are of many types. Before applying a new coating, the interior of the tank must be scraped and brushed clean to insure a good bond. Lumnite mixed with water to form a thick paste is an excellent coating which is easily "painted" on with a brush. After application, it is necessary to wait about a day to permit the coating surface to harden. The tank may then be closed.

For manhole gaskets, a graphite-oil paste or graphite-water paste serves well to prevent hardening. In many industrial heaters, where lumnite and graphite coatings have been used, the maintenance men have reported excellent service for periods of three years and longer. Annual inspection of the coating is usually sufficient, and at that time all blisters and peelings should be cut away and the spots recoated.

Steam Section

Troubles occur more frequently in the steam section than in the storage section. Corrosion, scaling of heater-coil tubes, tube leaks, faulty drip traps, dirty strainers, and improperly functioning steam gages are common faults. Annual inspection of the steam coils is necessary to make certain that they are in good condition. Complete removal of the coil frm the tank is usually necessary to permit thorough inspection.

Corrosion of tube interior is generally caused by boiler compounds being carried over by the steam into the tubes, or by excessive air accumulation in the tubes. Excessive steam temperatures, steam containing large quantities of moisture, and improperly treated water may cause tube scaling. All these troubles, except air accumulation, can be traced back to the boiler room, where they can be eliminated by careful studies of operating conditions.

Excessive air accumulation in the heater tubes often causes very serious corrosion problems besides reducing heater capacity. The coil air vent should be checked semi-annually to see that it functions properly; in particular, there should not be excessive friction between moving parts. Where a vacuum breaker is used, a similar inspection at the same interval is necessary.

Air in heater coils should be eliminated as quickly as possible. Pinhole leaks in the coils caused by corrosion can often be plugged successfully by welding, providing the tube metal is of the proper type. Otherwise, replacement of the coil is necessary.

Drip traps, strainers, and steam gages should receive as much care as similar equipment on production machinery. Trap maintenance is an art in itself, but if a well-organized maintenance schedule already exists in the industrial plant, the coil trap can readily be included. Strainers, of course, should be cleaned whenever necessary; experience indicates that once a month is generally sufficient during periods of normal operation.

Steam gages which give incorrect readings are worthless. Low readings may cause tube scaling because the operator, thinking that the water temperature will fall, manually increases steam pressure with resultant overheating. High readings may cause low water temperature. Therefore, these gages should be calibrated regularly.

Control Section

It is in the automatic-control section of the heater where most troubles are found. Poorly adjusted steam regulating valves, corroded or scaled thermostats, improperly reading thermometers and unreliable relief valves cause more headaches among plant engineers than any other part. Neglect and poor adjustment cause most of these troubles; since both conditions can readily be avoided, there is no reason why these troubles should exist. Regular monthly inspections of all control equipment will eliminate troubles resulting from neglect.

Securing specialized advice from the manufacturer of the control equipment will prevent poor adjustment by members of the maintenance department who enjoy tinkering and experimenting. Manufacturers representatives will gladly adjust steam regulating valves.

Thermostats should be inspected and cleaned semi-annually because scale and organic growths, which accumulate on the "feeler" tube, cause faulty operation. Extreme care is necessary during the cleaning operation because thermostat tubes are readily damaged by sharp tools carelessly used.

Broken, dusty, dirty, and leaky thermometers are another common sight in poorly maintained industrial plants. In others, the thermometer looks good but gives incorrect readings. Since the thermometer is the only means of determining the heater-water temperature, it should be in good working order at all times. By purchasing a new thermometer and locating it in a small can of hot water, comparisons between its readings and those from the hot-water heater will give a good indication of the accuracy of the latter. Of course, the feeler elements of both thermometers should be placed in the same can of water.

Heater relief valves, often high above the floor and inaccessible, should not be neglected. They are extremely important in an emergency. Cleanliness and adjustment are important.

Ladders, vacuum cleaners, wire brushes, interior coatings, spare gaskets, and spare valve and trap parts are a few items which will make maintenance of hot-water heaters easier. A clean, well painted exterior will go a long way towards improving plant appearance and personnel interest. Kept clean and scale-free, hot-water heaters have lasted 30 years and longer, all the while giving excellent service and proper water temperatures.

There is no need for dirty, corroded, and sagging water heaters. A good maintenance program, faithfully followed, will keep them in good working order and keep them from becoming eyesores. Better production, a cleaner plant, and happier personnel are certain to result, from the effort required.

HOT-WATER TEMPERATURES FOR PLANT SERVICES

Service:	Temperature, F
Process	100 to 212*
Kitchen	130*
Cafeterias	130*
Lavatories	130
Showers	130
Slop sinks (floor cleaning)	150
Slop sinks (window cleaning, etc.)	130

*Also steam for special service requirements.

COMMON TROUBLES WITH HOT-WATER HEATERS

Water-Tank Section

Coating:
Loose, blistered, coated with organic growths.

Drain:
Broken, dirty, corroded.

Gaskets:
Leaky, hardened, broken.

Valves:
Clogged, broken, corroded.

Tank:
Corroded, loose coating, sludge accumulation.

Steam-Coil Section

Air vent:
Excessive friction, broken, clogged, corroded.

Tubes:
Leaky, scaled, corroded, air bound.

Traps:
Leaky, worn, corroded, air bound.

Steam gage:
Broken pointer, glass or spring; leaks; scale; distorted tube; out of calibration.

Strainer:
Clogged, corroded.

Automatic-Control Section

Thermometer:
Broken tube, organic growths on stem, dirty, improperly calibrated.

Steam regulating valve:
Improperly adjusted; worn parts, controls.

Relief valve:
Clogged, dirty, leaking.

Thermostat:
Corroded, organic growths, broken bulb.

Electricity or air supply:
Faulty connections, dirty contacts, corroded pipes, broken wires.

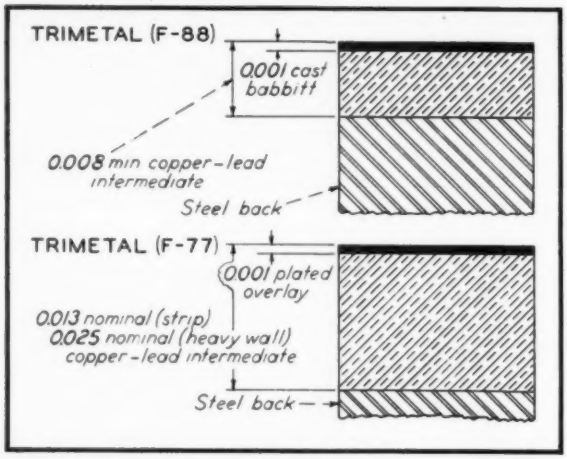


Fig. 1—Metals need not stick together, but they must have a chemical bond in order to give satisfactory performance

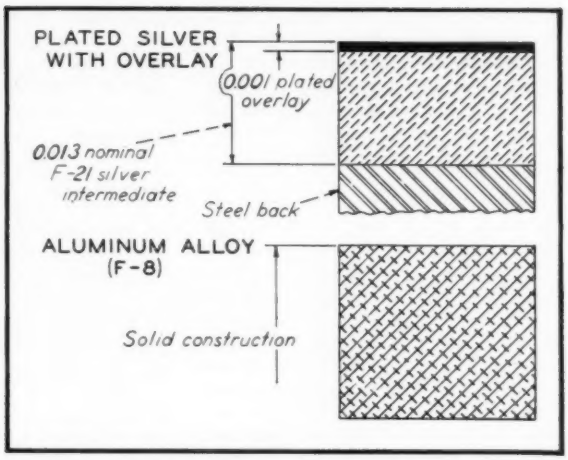


Fig. 2—Overlay lining uniformity is of prime importance, but bearing life increases when this thickness diminishes

Bearing Composition, Application and

Development of new metals, sounder basic design and proper application has made possible the advances of bearing durability as it is known today. Load factors of twenty years ago have been surpassed, and the future can look forward to even greater increases. Proper installation is still a necessary factor

E. CRANKSHAW, *Assistant Chief Engineer*
The Cleveland Graphite Bronze Co.

SEVERAL FACTORS that control the value of a metal or an alloy as a bearing material are load-carrying ability, conformability, embedability, oiliness and corrosion resistance. Load factor as it is known today has increased beyond requirements of two decades or more ago. Industrial demand for greater load-carrying capacity can explain the many changes in bearing metallurgy, mechanical design and also basic bearing engineering thinking.

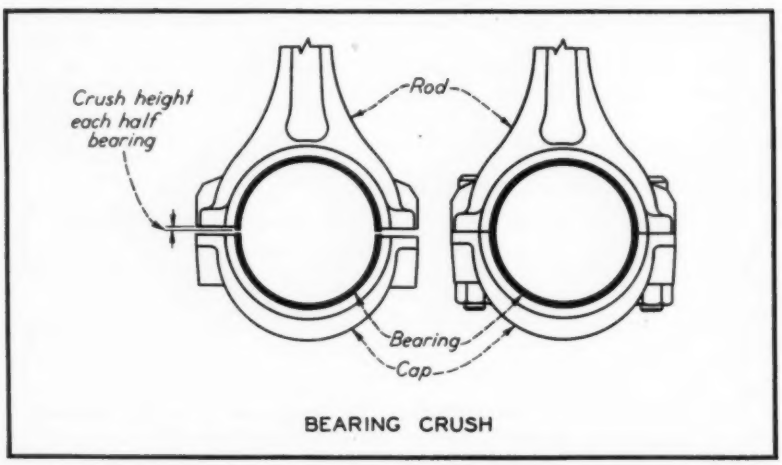


Fig. 3—First consideration for bearing protection is proper installation. Shells must fit tightly with bolts pulled up enough to hold the cap and housing together

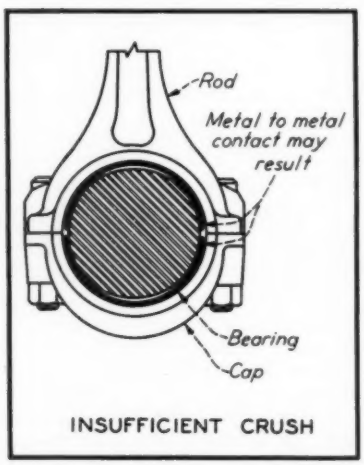


Fig. 4—Imperfect fit permits reduced clearance and causes poor lubrication

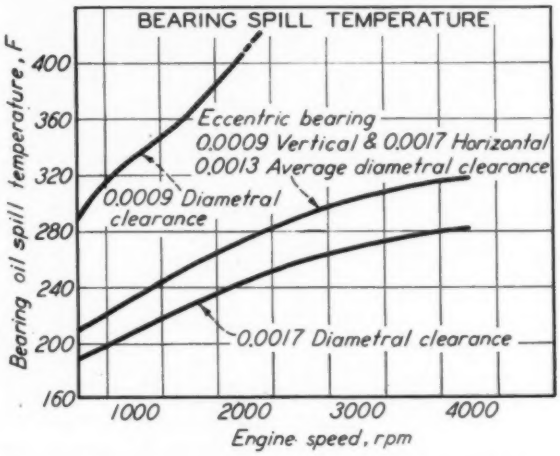


Fig. 5—Oil temperatures in concentric bearings range from 332 to 403F compared to 230 and 272F in eccentric bearings

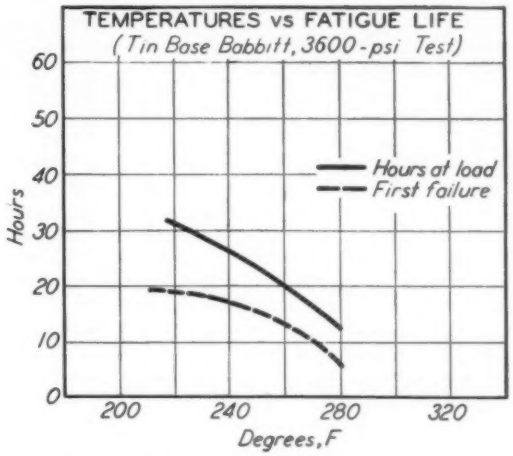


Fig. 6—High temperatures resulting from low clearance and oil level cause reduction of bearing life and performance

Durability---Today and in the Future

Babbitt, even when in special combinations, could not operate under the increasingly heavy loads. Despite this fact, the alloy produced by Isaac Babbitt in 1839 is still the best material from every point of view except load capacity. In an effort to meet the new demands, a multiplicity of metallic combinations has been tried.

Some of the newer materials allow greater loading, but they have proved less desirable in other aspects. High-leaded copper alloys carry greater loads but are susceptible to corrosion where these conditions are allowed to exist. Any additional alloying elements, which have been added to increase corrosion resistance, have resulted in increased seizure sensitivity. Cadmium-nickel or cadmium-silver combinations can carry appreciably heavier loads than babbitt, but these combinations will corrode excessively even under normal and usual engine operating conditions.

One of the more recent bearing metals is silver. Early application of silver indicated a thin, soft metal overlay either of lead-indium or lead-tin plating was necessary. This construction is satisfactory where lubrication is as nearly perfect as possible; where operating conditions are almost mechanically ideal; and where the life expectance is not unduly long. Consequently, the aviation industry uses silver, but in the automotive and diesel field silver is

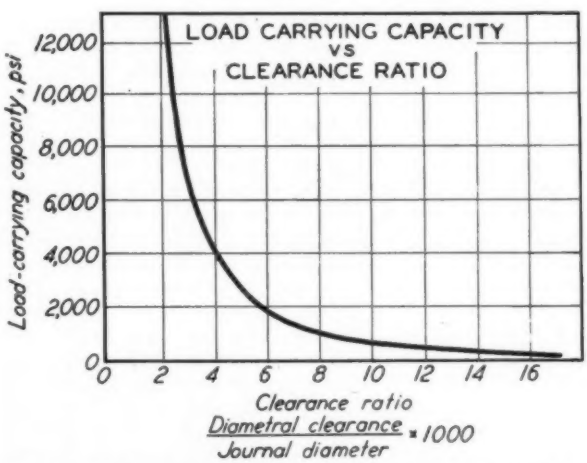


Fig. 7—As clearance decreases, carrying capacity increases, but other factors limit clearance such as minimum oil film

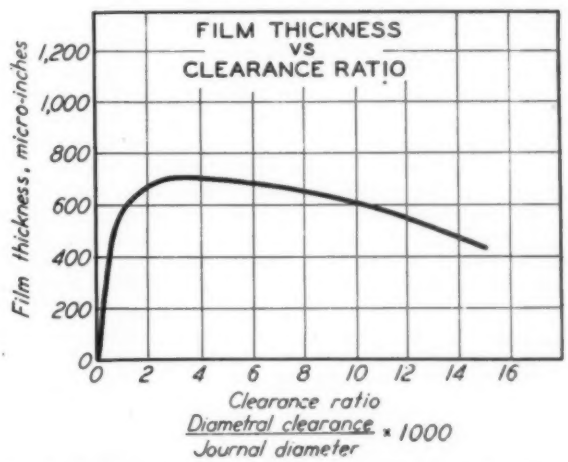


Fig. 8—Maximum oil film vs optimum clearance ratio gives fattest oil film thickness for any given set of conditions

entirely impractical at the present time.

Bearing design has been slowly changing for the last 20 years and is now beginning to emerge as an engineering science. During this comparatively short time several fundamentals have been discovered and substantiated. First, the effective thickness of material is of prime importance.

When babbitt thickness is plotted against bearing life, the importance of this thickness can be clearly demonstrated. Expected life is of extremely short duration and follows a straight line when a babbitt thickness over 0.015 in. is used. Also, life expectancy increases as the wall thickness diminishes. The value of this observation cannot be overestimated. This basic finding is, namely, that the bearing or anti-friction properties depend wholly on surface action. Greater inherent strength in the backing material, where it can assume a greater loading share, results in longer bearing life.

One closely connected factor is the bonding between backing material and bearing alloy. To have the bearing backing and lining stick together is no longer sufficient. The two metals must be chemically united at their interfaces in order to give best service. Spotty or weak bond invariably results in early failure. With this knowledge a trimetal construction was developed. Fig. 1 and 2 show some of the typical constructions, which are apt to be encountered.

With the advent of the thin-walled bearing (any wall up to 5/16 in.) several new factors arise that are extremely important. First, from a mechanical standpoint, is the crush fit, because so many other advantageous or definitely dangerous points depend upon proper amount of crush.

Proper Installation

Precision bearings must be installed so that the bearing shells fit tightly in the rod or case bores. Experience from many carefully made installations has provided a proper set of standards for bearing crush, Fig. 3. This overcomes the wide variation in crush formerly resulting from varied opinions of individual mechanics. The bearing engineer calculates the vertical height of each half bearing slightly greater than half the bore diameter into which they are assembled. When the assembly is drawn tight, the bearing is compressed this extra height and assures a good contact between bearing back and bore into which it is seated. This extra vertical height is referred to as "crush".

Calculation of crush takes into account strength of housing, rod, cap and the bolts used to hold cap and housing together. To obtain proper bearing assembly and operation the bolts should be tightened evenly.

When the backs of the bearing and bore do not make perfect contact because of insufficient crush, Fig 4, the following troubles might occur: 1—Normal running clearance is reduced. After a short period of operation the bearing may close in across the split line until it contacts the journal surface, and thus tend to shear the oil film, 2—Bearings have a tendency to move slightly in the housing. This causes scuffing, and 3—Loose bearings permit oil to carry dirt in between the bearing back and rod or case bore, and the localized loading might cause premature failure.

Actual selection of material and construction is dependent upon: operating conditions of temperature, dust and vapor; service factors; fuels and lubricants; and life expectancy. For instance, in obtaining utmost reliability for aviation units, short term re-builds are made with earlier replacement of vital parts. In other cases, some stationary engines are expected to run continuously for several years under conservative operating and servicing conditions. Longer bearing life is obtained only by reduction of loading.

Bearing Temperatures

Concentric bearings, under the minimum clearance conditions of 0.0009 in. and operating 1000 rpm, have an oil flow temperature of 332 F, Fig. 5. When operated at 2000 rpm the temperature is 403 F. On the other hand, eccentric bearings (0.0009 in. vertical and 0.0017 in. horizontal clearance) running at 1000 rpm have a temperature of 230 F, and at 2000 rpm only 272 F. High temperatures caused by low clearance and insufficient oil flow have several bad effects on bearing performance. Among these is rapid reduction in fatigue life of material, Fig. 6.

As the temperature increases, viscosity of oil decreases thereby reducing the minimum oil film thickness and strength. With high operating temperatures, alignment from bearing to bearing, minimum shaft distortion, and minimum taper in the bearing housing bore and on the journal surface are necessary. This reduces danger of localized load areas and oil film breakdown.

Further undesirable conditions center around the fact that bearing alloy hardness decreases with temperature rise. For example tin-base babbitt has a Brinell hardness of 25.5 at 80 F, 14.0 at 212 F and 9.2 at 300 F. Compression strength at 80 F is 13,000 psi, at 212 F 8,000 psi and at 300 F 5,300 psi. Under high temperatures, where the minimum oil film thickness is extremely thin, bearing material becomes relatively soft. Consequently foreign substance in the oil, possible misalignment of shaft distortion, severe metal-to-metal contact and wiping of the bearing face or shaft scoring, often occur.

Oil Film Strength

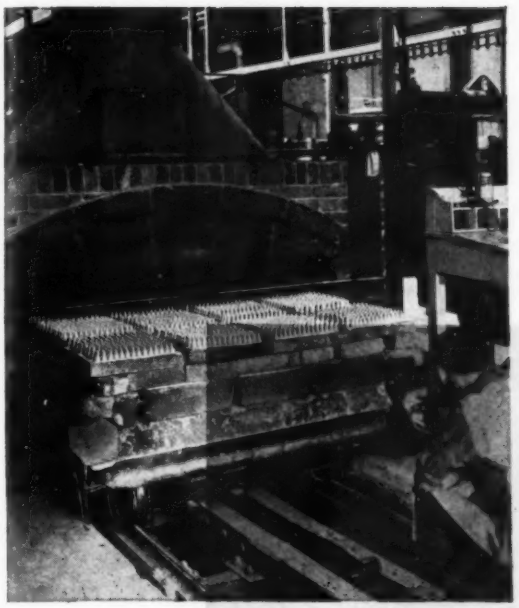
Strength of an oil film, measured as load-carrying capacity, is plotted against the clearance ratio for a typical bearing, (Fig. 7). The assumption has been made, however, that constant viscosity and eccentricity are maintained. The curve indicates, as clearance decreases because of oil film thinning, the load-carrying capacity approaches infinity. Unfortunately several opposing factors occur when the clearance changes. Some of these are how thin the film can become and still furnish full lubrication, and less oil means a more rapid film temperature rise. To lay down a hard and fast formula is impossible although dependable data are available, if unidirectional loading operation were considered. Of course, in the realm of film thickness mechanisms, as with oil flow, the engineer is without information on rotating load applications.

Based on the theory of an optimum clearance ratio, Fig. 8 offers the film thickness for set conditions. This again may be accurate for unidirectional load, but the effect of the rotating and shock load has not been evaluated. Applying this theory to journal bearings and employing rotating load, a clearance range can be determined that will suit.

Extensive field data conflict because of the many variables experienced in engine operation. For example: various types of grooving; methods of feeding oil (through the bearing or shaft); applicability of hydro-dynamic theory, when oil is not introduced under pressure (splash or ring feed); and high speed factors (oil film whirl, erosion and cavitation). Data along with laboratory test results must be analyzed and correlated with theory before they can be used with assurance for design purposes.

Something of a more measurable quality is lubricant corrosiveness. Every hydro-carbon lubricant will break down by oxidation under certain conditions. The reaction products are complex organic acids, which are highly corrosive, particularly to lead, lead alloys, cadmium and its alloys. Many good inhabited oils are available. But, too often the operator does not realize the importance of his contribution if performance is to be satisfactory.

Present-day bearing materials even though improved do not prevent all failures. Three of these factors are: (1) substantial increases in rated engine output without fundamental design changes, (2) improper installation and (3) sustained engine demands beyond designed intentions. All three can result in early unsuspected bearing failures or, at best, short bearing life.



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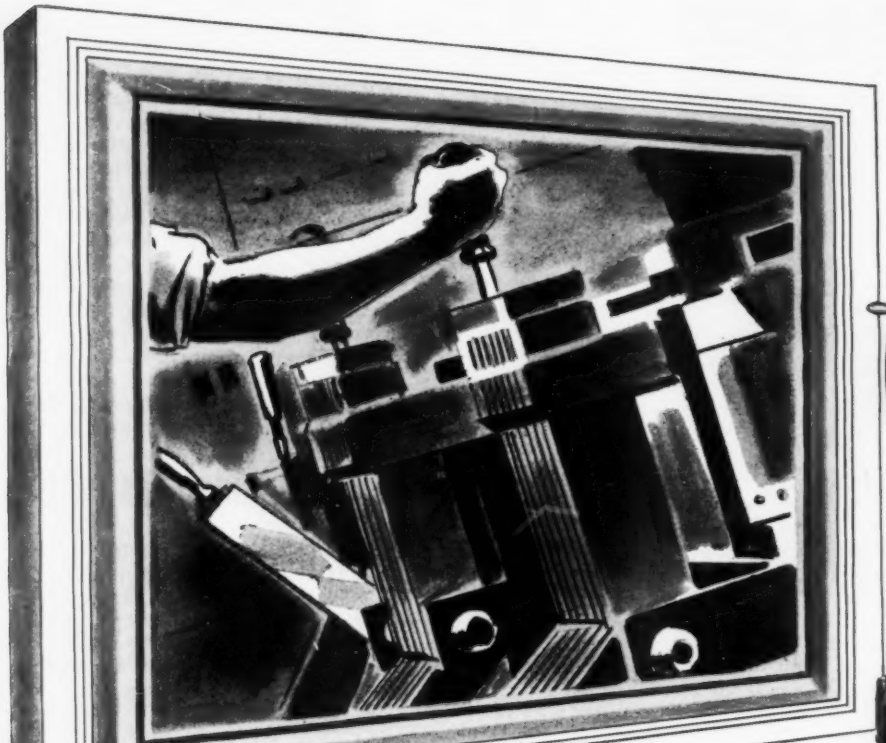

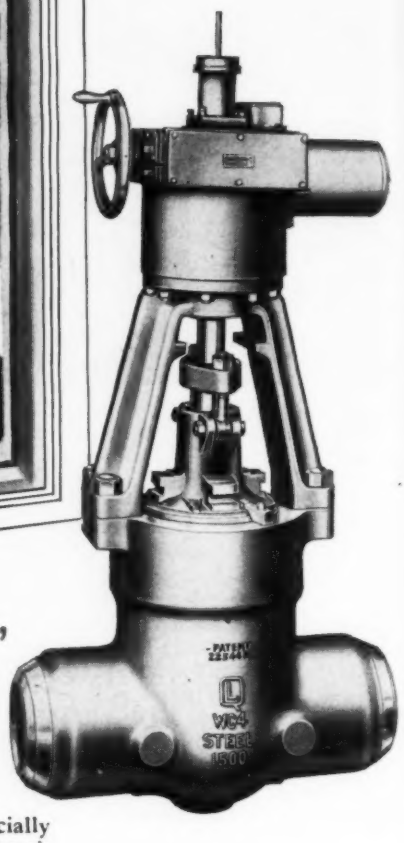

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Plant Engineer's Handbook

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EVAPORATOR LOCATION

JOHN D. CONSTANCE

IN AN AIR-CONDITIONING or refrigerating installation where the evaporator must be located some distance above the condensing unit you must consider the effect of this vertical distance on effective refrigerating capacity of the coil. Long vertical liquid refrigerant lines may, under certain conditions, reduce the amount of liquid entering the evaporator, Fig. 1.

Let's first consider the pressure in a vertical pipeline as it varies with liquid-column height. Thus, if the pressure at the base of a vertical pipeline of water is 43.3 psi we know the water column must be 100 ft high if its surface at the top is vented to atmospheric pressure.

The pressure will fall off 1 psi for every 2.3 ft the water level drops. Measured 23 ft above the base, the pressure will be 33.3 psi or 10 psi less. The same pressure variation occurs in a vertical line of Freon-12, but here the effect causes a physical change in the main body of the liquid.

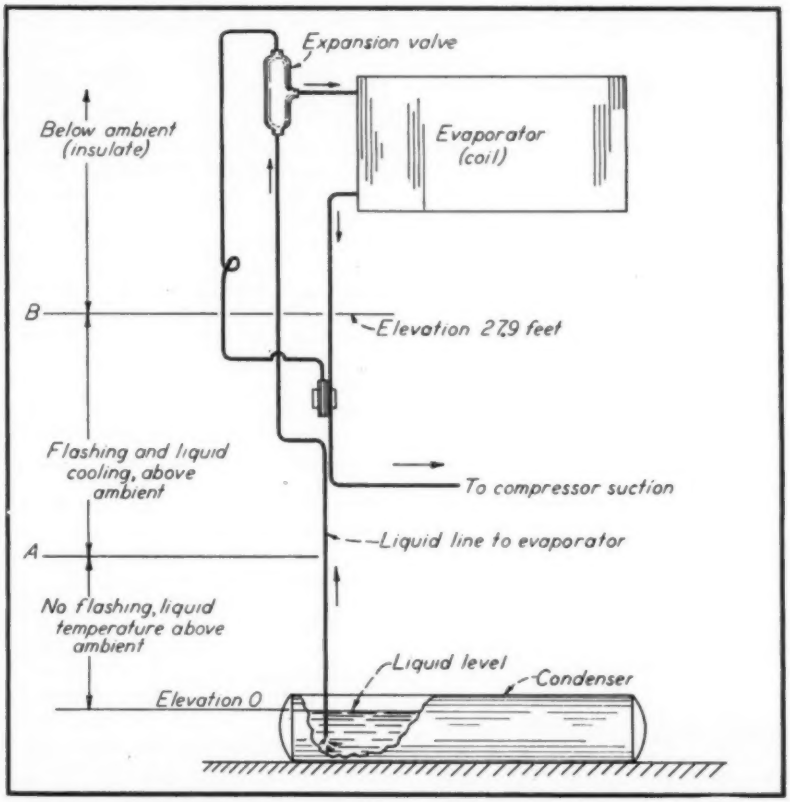

Fig. 1—Highest pressure in a vertical liquid line occurs at the foot of the pipe. Progressing up the line, pressure diminishes according to the altitude

At ordinary room temperature the density of each foot of water does not materially vary. Freon-12, however, does not reflect such constant-density conditions, because a portion of the liquid "flashes" into vapor at a certain level corresponding to a definite pressure. The table compares water and Freon-12 thermodynamically as to temperature and its corresponding saturation pressure in the operating range usually met in practice.

The difference in pressures shows that, for the same temperature, a much greater pressure is required to keep Freon-12 from "flashing". In other words, it requires a much greater vertical head to maintain the refrigerant in a liquid state.

The amount of refrigerant liquid vaporizing depends on the pressure also. As the pressure gets lower, (vertical rise) providing the liquid is at saturation conditions shown in the table, more and more liquid will "flash". The lower the final pressure (higher up in the pipeline) the greater will be the weight "flashed" and thereby made useless as far as its refrigerating effect is concerned. The process is known as "wire drawing" or throttling, and is similar to that which takes place in flow through expansion valves, orifices and other constrictions under so-called "uncontrolled" conditions.

Our discussion so far has been based on the assumption that the system is perfectly insulated and "flashing" has not occurred as a result of heat flow through the pipe walls.

Ideally speaking, the greatest refrigerating effect will be realized when the expansion valve is located adjacent to the evaporator as in Fig. 1. Any "flashing" will then occur in the coil and the drop in temperature will aid refrigeration. Good design precludes "flashing" taking place anywhere except in the expansion valve. Valve ca-

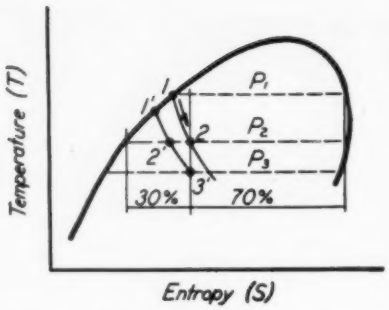

Fig. 2—Use temperature-entropy chart to study refrigerant altitude problems

pacity is then highest and valve-seat life longest.

Liquid Freon-12 leaving the condenser is at its condensing temperature. Thus, if the condensing pressure is 114.3 psia, the table shows the condensing temperature should be 90 F, assuming the complete absence of non-condensable gas in the piping.

Sub-cooled Liquid

If sub-cooling has taken place inside the condenser, because of better-than-average condensing conditions, the liquid refrigerant may leave at a temperature 10 F lower than that corresponding to the saturation condensing pressure. For instance, if the temperature leaving is 80 instead of 90 F the liquid will not "flash" until the pressure in the liquid column falls below the corresponding pressure of 98.8 psia —level *A* in Fig. 1. Above this point there will exist a mixture of saturated liquid and vapor, the vapor component becoming greater as the height increases above *A*. Should liquid leave saturated at 90 F, "flashing" will take place below level *A*.

We stated previously that the amount or weight of liquid "flashed" depends on the pressure drop. So let's use a skeleton temperature-entropy (T-S) chart to show the throttling process, Fig 2. Assume P_1 is the condensing pressure and P_2 the pressure at a certain level in the column where "flashing" is taking place.

If liquid leaving the condenser is saturated, its condition may be shown as point 1, and the sub-cooled condition at a lower temperature, as point 1′. As the pressure is lowered "flashing" takes place along line 1-2 or 1′-2′.

These lines are called the constant-heat lines and develop under completely insulated conditions. The amount of each original pound of liquid "flashed" may be determined graphically as follows: If point 2 or 2′, whatever the case may be, lies 30% of the linear distance along P_1 bounded by the curve, then for all practical reasons 0.3 of the pound of liquid at point 1 has "flashed" into vapor at conditions described as P_2.

Further examination confirms our previous point that under sub-cooled conditions less of the liquid will "flash" at P_2, leaving a greater weight to accomplish its refrigerating effect in the evaporator. In terms of final pressure we can also see that a lower coil pressure, P_3, may be tolerated to produce the same effect at point 3′. Translating this into the pipeline picture, point 1 may be at the condenser while point 2 may be above level *A* in Fig. 1.

Again referring to Fig. 1, as long as the Freon liquid temperature is above the ambient, vaporization is due to pressure drop alone. But just as soon as self-cooling takes place and the liquid temperature drops below the ambient, the liquid will suffer a heat gain through the pipe walls and vaporization will be increased. Therefore, between *A* and *B* "flashing" takes place only at the expense of self-cooling; beyond level *B* heat leaks aid vaporization. Since this is the critical altitude, the line should be insulated above level *B* to the evaporator. On the other hand, the evaporator should be located below level *B* if possible.

TEMPERATURE vs PRESSURE

Temp. F	Saturation Pressure, psia Freon	Water
80	98.8	0.5067
82	101.7	0.5409
84	104.8	0.5772
86	107.9	0.6153
88	111.1	0.6555
90	114.3	0.6980
92	117.7	0.7429
94	121.0	0.7902
96	124.5	0.8403
98	128.0	0.8930
100	131.6	0.9487

It is convenient to be able to determine the pressure in the pipeline where the refrigerant has been self-cooled to a temperature coincident with ambient. Suppose the atmospheric temperature is 90 F. From the table the corresponding saturation pressure is 114.3 psia (99.6 psi gage). If condensing temperature is 100 F the gage saturation pressure is 116.9.

Accordingly, the pressure exerted by the liquid plus vapor head above the condenser is 116.9—99.6=17.3 psi. From thermodynamic tables the density of Freon-12 varies from 82.6 lb per cu ft at 70 F to 76.0 at 120 F. An average of 80 has been used with good results. The level at *B* may be determined by

$$17.3/80 \times 144 = 31.1 \text{ ft}$$

above the liquid level in the condenser.

It is obvious that the ambient air temperature affects the level of *B*. The higher the ambient the lower will be the location of *B*. Therefore, in deciding how much of the liquid line to insulate, it is necessary to estimate the highest possible ambient that may be encountered. In our example, if the evaporator is located at elevation 40.0 ft, then 40—31.1=8.9 ft, the length of liquid line we would have to insulate.

Any heat given off by the line up to *B* would increase the capacity of the refrigerating system. Sub-cooling would take place as a result of sensible heat loss to the atmosphere.

Line Friction

In an actual installation the liquid Freon-12 suffers a pressure drop due to line friction.

Example: An evaporator coil in an air conditioner using Freon-12 is located 10 ft above the condensing unit. Discharge pressure is 108 psig and suction pressure at the compressor intake is 43 psig. Pressure drop through the evaporator is 14 psi and 35 through the expansion valve. Find the allowable pressure drop through the liquid line if 4-psi is considered a good safety allowance.

Solution: The difference between head and suction pressure is the working pressure to be dissipated among the various pieces of equipment and liquid line. Thus, 108—43=65 psi.

Drop through the evaporator is 14 psi, leaving a net pressure at this point of 65—14=51 psi. Drop through the expansion valve leaves 51—35=16 psi. Allowing 0.6 psi for every foot height of liquid line above the condensing unit we have 10 x 0.6=6 psi, or 16—6=10. Subtracting the safety allowance of 4, the allowable pressure drop to be taken by the liquid line is 6 psi. *Ans.*

Suppose we determine the amount of Freon-12 that will flash into vapor upon a drop in pressure from 116.9 to 99.6 psig. Between these terminal pressures the following takes place, assuming an ideally insulated system:

Heat of liquid at 116.9 psig=heat of flashed vapor at 99.6+heat of saturated liquid at 99.6. Thus, the numerical determination is:

$$31.16 = 28.7\,X + 87.84\,(1-X)$$

where X is weight fraction of 1 lb of Freon-12 "not flashed".

Solving for X we have 0.958 lb liquid remaining.

Then: 1—X=0.042 lb of original liquid "flashed".

For each pound of Freon-12 reaching the expansion valve, 1 ÷ 0.958= 1.043 lb must leave the condensing unit.

It is obvious from the above that liquid lines should be kept as short as possible for best performance without adding other equipment designed to prevent "flashing" in the pipeline.

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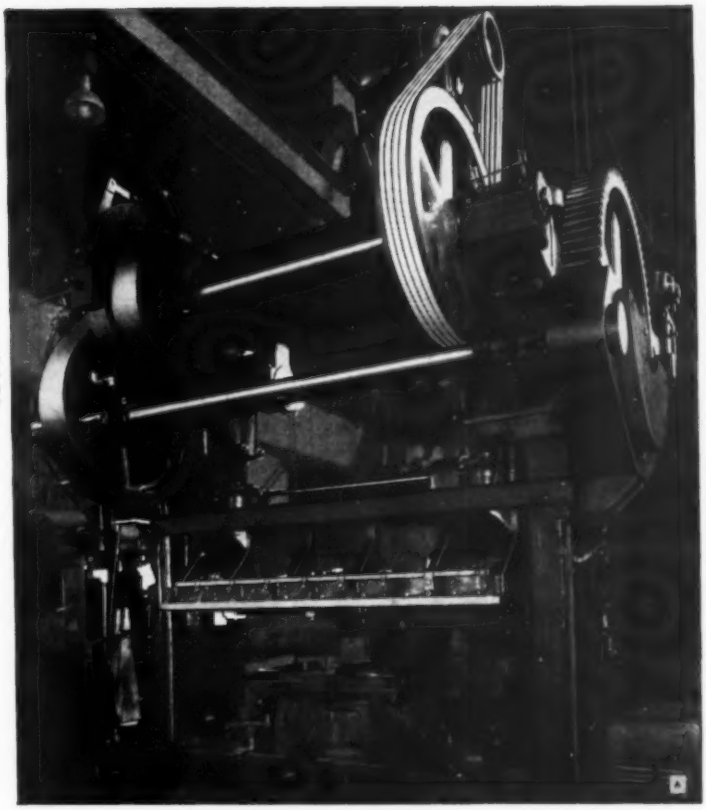

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To see for yourself the belt-saving importance of the Concave Side, just pick up *any* V-belt and bend it as it bends when it goes around a pulley.

As the belt bends, grip its *sides* firmly with your fingers. You will feel the sides of the belt *change shape.* This is because the top of the belt is under tension and, hence, grows *narrower* while the body, under compression, *bulges out.* (See figure 1 and 1-A)

Now look at figures 2 and 2-A. There you see how the bending changes the shape of the belt that is built with the Concave Side —The Gates Vulco Rope. The concave sides of this belt merely *fill out* and become perfectly *straight.* There is no side-bulge. This belt, when bent, *precisely fits its sheave groove.*

A very distinct saving in belt wear results. No side-bulge means that the sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in longer life for the sidewall and, naturally, *longer life for the belt!*

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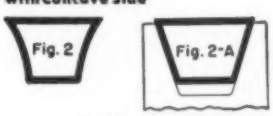
What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear at Point Shown by Arrows.

Gates Vulco Rope with Concave Side



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Spot News

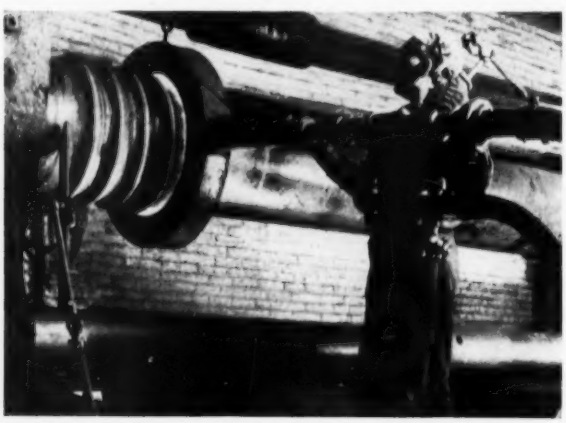
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Metal-Fabricating Device Shapes 30 in. Corrugated Pipe

Chrome-moly, corrugated 30 in. pipes are now being formed in a unique device in the metal-fabricating shops of The M. W. Kellogg Co.

Totalling some 90 ft over-all, eight pieces of this relatively large diameter pipe were shaped for the major part of the exhaust-steam line from a topping turbine.

Beyond physical size itself, the major problem in fabrication was to preclude cracking, a defect much more apt to



occur in forming chrome-moly than in working either carbon or carbon-moly steels. The corrugations were made possible by carefully controlled incremental heating and subsequent compression on this specially devised machine. The final corrugation has five times the plain piping flexibility.

Furfural Acts as Solvent in Extraction Unit

Furfural is now being employed as the solvent in the first commercial extraction unit designed specifically to produce diesel and domestic heating fuels. This solvent is utilized in the oil industry to remove sludge producing elements in motor oils. Now the method has been adapted by The Texas Company at their new $60,000,000 Eagle Point, New Jersey, refinery.

Basic value is in the substantial improvement of cetane number in diesel fuels, improved burning quality of domestic heating fuels and the reduction in sulfur content of all products. This might offer a solution to a major oil industry problem.

Design resulted from prolonged study of laboratory data and pilot unit work as well as experience gained from two years' operation of a semi-commercial plant at The Texas Company's Los Angeles, California refinery. This semi-commercial plant produced as many as 2,500 bbl per day of refined gas oils from various charging stocks.

Early output has closely duplicated product qualities obtained previously in pilot unit studies. This unit embodies two fractionators, a simplified treating tower and product strippers. A variety of gas oils will be treated that differ widely in boiling range, high or low sulfur content and moderately or deeply cracked stocks.

The unit operates at extraction temperatures only slightly above atmospheric and heating expenses are unusually low.

"Push Button Control" Operates Four Pumping Stations 1000 Miles Away

Telephone dial on a dispatcher's desk in the Shell Oil Company's New York City office now operates automatic petroleum pumping stations almost 1000 miles away. This new method of pipe line control was developed to meet the increased demand for petroleum products. The demand is particularly large during the winter months when fuel oil predominates. To meet this required increase, four new pumping stations were installed between the Wood River, Illinois refinery, near St. Louis, and Columbus, Ohio, each with a single 500-hp pump motor. The stations are designed to be as fully automatic as possible so that the dispatcher can start or stop the station and take instrument readings from his desk in the RCA building, New York City.

In order to make best use of the existing leased network teletype facilities, General Electric & Shell engineers collaborated with American Telephone and Telegraph.

Relays permit switchgear to set up a "Station Run" se-

quence at any one of the four new stations when the proper code letter is dialed in the dispatcher's office. The "Station Run" sequence is as follows: 1) starts an oil pressuring pump to lubricate seals in the main pump; 2) opens the motor-operated suction valve; 3) starts the 500-hp pump motor (full voltage start) and 4) opens the motor-operated main discharge valve to bring the station on the line. Shutdown is then effected by opening the "Station Run" relay, which shuts off the pump motor and simultaneously closes the motor-operated valves. A mechanical check valve in the line permits pipe-line flow to go past the pump when these valves are closed.

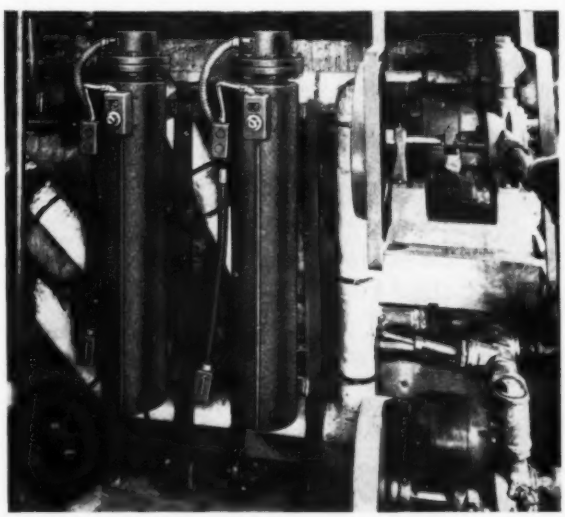
ASA Plays Host to International Organization for Standardization

The International Organization for Standardization has accepted an invitation to hold its 1952 General Assembly in the United States. Delegates of the 29 countries will be guests of the American Standards Association.

Seventy-one international technical committees are working to bring about agreement on definitions, terminology, specifications, dimensions, and test methods in the national standards of the member countries to increase understanding and easier interchange of products.

Preheated Heavy Fuel Oils Aid Handling and Combustion

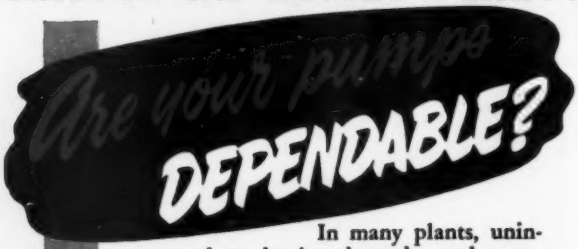
Light fuel oils, which can be readily pumped at ordinary temperatures, are being replaced by preheated, heavier, lower-cost grades having higher heating value. Heavier oils generally need preheating for easy pumping and efficient combustion. Changing over to heavier grade oil is simplified by adding Edwin L. Wiegand Co.'s Chromalox electric circulation heaters either at the storage tank or the point of use.



A typical installation is the heating of Bunker C fuel oil at the power plant of Polk Sanitary Milk Co., Indianapolis, Ind. Oil is preheated electrically and it flows to the burners. Heat is again applied with low-wattage cartridge heaters in the burner reservoirs.

One of two 10-kw circulation heaters operates 24 hr a day, seven days a week at the oil storage tank. The two 225-

ONE PUMP BREAKDOWN CAN CRIPPLE AN ENTIRE PLANT!



In many plants, uninterrupted production depends on the continuous operation of *one* pump. If it breaks down — everything stops while repairs are made. Whole days of production may be lost if it has to be replaced. To avoid this expensive risk, employ only the most dependable pumps — WEINMAN.

Our representatives will be glad to size-up your present pump installations and to tell you if they are adequate for your needs. Each is a specialist in centrifugal pumps, their design, application, and installation. They can help you stop trouble before it starts. Why not write, wire or call a WEINMAN Specialist today and make sure that your pumps are dependable.

WEINMAN Type "U" Non-Clogging Pumps for liquids carrying solids. Capacities from 100 G.P.M. to 2000 G.P.M. Heads to 105 feet.
WEINMAN Type 60 and 120 pumps available with or without leak-proof mechanical shaft seals—capacities up to 1000 G.P.M. Heads up to 200 feet.
Representatives in Principal Cities
Built by Centrifugal Specialists
The WEINMAN Pump Mfg. Co.

hp boilers each require 55 gal of oil per hr. Normally one circulation heater is used to facilitate pumping and proper combustion. The second cuts in instantly and automatically when needed. Pumping rate and outside temperature are factors that determine whether either or both heaters operate. Built-in control prevents under-or over-heating.

Vertical Shaft Centrifugal Pump Undergoes First Test Run

First of ten vertical shaft centrifugal pumping units, for the Bryant Street Pumping Station, Washington, D. C., was tested recently at the Harrison (N. J.) Works of Worthington Pump and Machinery Corp. These pumps will replace existing equipment considered obsolete. Pumped water will be distributed into the system for the low, first, second and third high service.

Three of the pumps in low service are rated at 35 mgd, three in the first high service at 35 mgd, two in second high service at 25 mgd, and two in third high service at 15 mgd. Each pump will be driven by a synchronous motor, close-coupled to the pump and mounted on a cradle supported from the pump casing. Motors range from 325 to 1100-hp.

Adding Graphite to Oil Improved Engine Performance

Roadtests on a Plymouth automobile, run over 235,000 miles showed that the addition of coloidal graphite to engine oil resulted in an average saving of 30% in oil and 10% in gasoline. The principle is applicable to any internal combustion engine.

The test car received a piston-ring job at 87,000 miles, and a rebore at 187,000 miles. After the rebore the largest piston that could be installed was 10 thousandths oversize.

Colloidal graphite particles, unctuous and microscopically fine, adhere tenaciously to metal cylinder walls and bearings to a greater degree than plain oil. A "graphoid" film is formed that is difficult to wipe dry. This surface will supposedly support a thinner film of lubricant without rupture than will the metal alone. However, if a rupture should occur, metal-to-metal contact is avoided by the film.

Power Show to Have Extensive Smoke Control Exhibits

Current efforts to activate New York City's smoke control ordinance lend special interest to the 19th Exposition of Power and Mechanical Engineering, which will be held in Grand Central Palace November 27 to December 2. Plans for the exposition are far advanced, assuring exhibits covering every aspect of power from the raw fuel to the light switch or the production machine. A large proportion of the exhibits will deal with fuels, fuel handling, combustion and improvements directly aimed at the suppression of fumes and dust.

This year's exposition will be held under the auspices of ASME, which has been interested in smoke control problems for many years. The model smoke law committee of the Society held its first meeting in 1940 and has been continuously active. It is responsible for a model draft that has been studied and used as a basis for law by more than one hundred cities.

While appliances designed especially to suppress smoke and dust are in the headlines, basic influences in which

(Continued on page 132)

MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

SEPTEMBER

Instrument Society of America—Houston Section of the Instrument Society of America has announced that the Instrument Conference and National Exhibit will be held September 10-14 at the Coliseum in Houston, Texas. W. H. Fortney, Chairman of the Committee will handle arrangements. Mr. Fortney is the instrument foreman at the Humble Oil & Refining Company's Baytown refinery.

National Instrument Conference—Fifth National Instrument Conference and Exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18-22, 1950. It will include technical sessions of the following participating societies: The Instrument Society of America, American Institute of Physics, Industrial and Regulators Division of the ASME, Institute of Radio Engineers, Instruments and Measurements Committee of the AIEE, and National Telemetering Forum.

The ISA Pre-Conference Instrument Maintenance Clinic, which was held for the first time last year at the St. Louis meeting, will be held again on Friday, Saturday and Sunday, September 15-17, immediately preceding the opening of the Instrument Conference on Monday. The clinic will be held in the rooms of the New York State Institute of Applied Arts and Sciences in Buffalo and will consist of ten 2-hour sessions.

American Society of Mechanical Engineers—Fall meeting will be held in the Hotel Sheraton, Worcester, Mass., September 19-21, 1950.

National Electronic Conference—A program heavily slanted toward industrial electronic application has been announced for the National Electronic Conference which will convene at the Edgewater Beach Hotel in Chicago for a three-day session, Sept. 25, 26, 27.

Corrosion Refresher Course—Nine lecture periods, with adequate time for discussions, have been scheduled tentatively at Cleveland, for the Case Institute of Technology corrosion course to be held Sept. 25 to 29, under direction of Dr. R. B. Hoxeng, Case Institute of Technology, Cleveland 6, Ohio.

OCTOBER

National Safety Congress—The 38th National Safety Congress and Exposition will be held Oct. 16 to 20 in Chicago, Ill. Sessions on industrial safety are scheduled at the Stevens, Congress and Morrison Hotels, and traffic safety sessions at the Congress. For more details write R. L. Forney, general secretary, National Safety Council, 425 North Michigan Ave., Chicago 11, Ill.

Water Conference—The eleventh annual Water Conference, sponsored by the Engineers' Society of Western Pennsylvania will be held at Hotel William Penn, Pittsburgh, Pa., Oct. 16 to 18

American Institute of Electrical Engineers—The fall meeting of the American Institute of Electrical Engineers will be held October 23 to 27 in the Skervin Hotel, Oklahoma City, Okla.

NOVEMBER

National Power Exposition and ASME Meeting—The 19th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, November 27th to December 2nd under the auspices of the ASME in conjunction with the Society's annual meeting. The 1950 exposition will be the first to be held under the auspices of the ASME.

Complete information may be secured from Grand Central Palace, New York 17, N. Y. Charles F. Roth, president of International Exposition Company is manager of the exposition. E. K. Stevens is associate manager.

REVIEWS of RECENT BOOKS. . . .

The latest books, read by the Plant Engineering Group, are reviewed here for your convenience. Write directly to the publisher for those in which you are interested

Water Treatment

"Betz Handbook of Industrial Water Conditioning," third edition, by W. H. & L. D. Betz. Published by W. H. & L. D. Betz, Gillingham and Worth Streets, Philadelphia 24, Pa. Illustrated. 200 pages. $3.00

Up to date and practical text in this handbook covers all phases of industrial water conditioning. The literature is especially adaptable for study, reading or as a reference. An effort has been made to present the subject matter in a direct, simple and interesting form so those not versed in chemical engineering of water conditioning will understand the basic principles involved.

This handbook is divided into two parts namely: Water Treatment and Water Analysis. The first part—Treatment—contains detailed discussions of the chemical and mechanical water

For a Small, Localized Supply of Warm or

HOT WATER

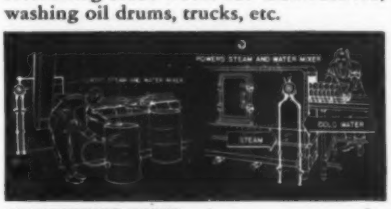
Use

POWERS

STEAM and WATER MIXERS

ECONOMICAL—Quickly pay back their cost. Thousands now in use. *Easy to Install.* Requires steam and water pressures above 10 lbs. Steam is mixed directly with water.

MANY USES—Industrial processes; 180° F. sterilizing rinse water for dishwashers; washing oil drums, trucks, etc.



TEMPERATURE RANGE—Any temperature desired between that of incoming water and 200° F.

HAS PRESSURE EQUALIZING VALVE—which prevents delivery temperature changes caused by fluctuating pressures of steam or water.

SMALL SIZE—½" pipe-size can be held in the palm of the hand, has 5" dial; ¾" size has 7" diam. dial.

CAPACITIES—based on steam and water at 45 lbs. pressure each, water at 60° F., and delivery temperature of 160° F.: —½" size =3 gals. per min.; ¾" size=8 gpm. Mixing steam with 140° F. water increases delivery about 75%. Often used as a small booster heater. ***WRITE for Bulletin 358-S***

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THE POWERS REGULATOR CO.
2777 Greenview Avenue Chicago 14, Illinois

Please Send Bulletin 358-S and prices

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Firm Name .....

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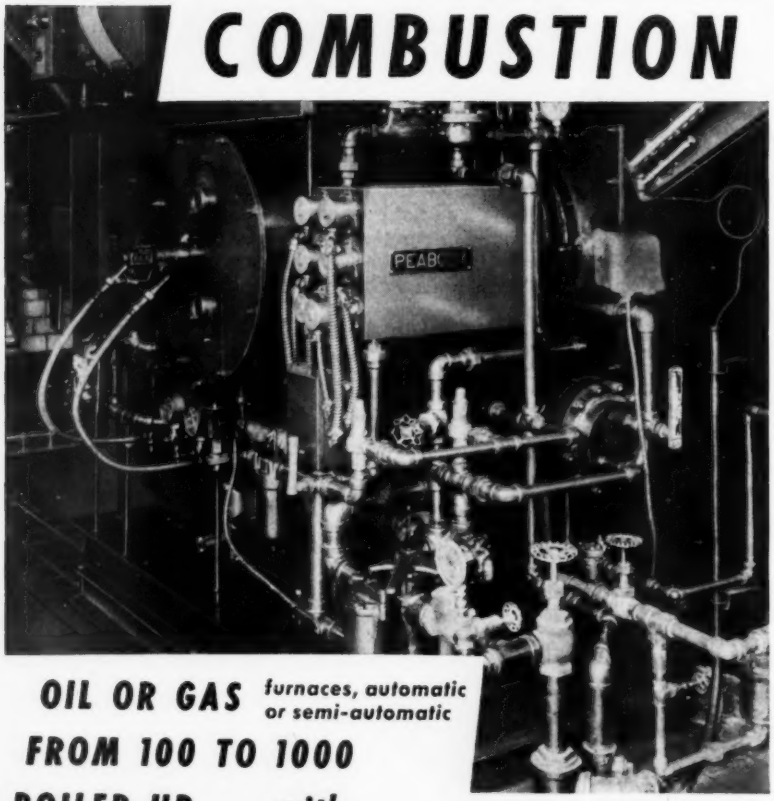

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FROM 100 TO 1000
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Complete and ready to go—just connect to service lines and you have an entire combustion system that handles heavy Bunker "C" oil from storage tank to combustion. Equally effective and convenient on the lighter fuel oils. This unit pumps, preheats, pressurizes and delivers oil to burner at proper viscosity, ignites and then burns it at proper firing rate. No auxiliary equipment required, no extra construction or engineering. Factory-mounted on single, reinforced base plate. Listed by Underwriter's Laboratories. Dependable and proved in the field! Write for Bulletin 400.

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treatment methods available for industrial usage. The second half covers the impurities in water, how they originate and how they can be controlled. Methods of analyses suitable for plant control are thoroughly detailed.

Tool Engineers Handbook

"Tool Engineers Handbook," edited by Frank W. Wilson, Editor-in-chief, American Society of Tool Engineers. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 18, N. Y. Illustrated. 2,000 pages. $15.00

This handbook is a reference volume that covers all phases of planning, control, design, tooling and operations involved in the mechanical processing of finished products. It is arranged to give the answers to tool problems in the shortest possible time.

Over 144 authorities contributed the lastest information on tool design, fabrication, maintenance and utilization. In all, 115 sections are included, each well illustrated with drawings, photographs and tables. Of particular importance is the well planned index, which aids in finding data immediately.

Atomic Energy

"Pocket Encyclopedia of Atomic Energy," by Frank Gaynor, Published by Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. Illustrated. 204 pages. $7.50.

This book is a comprehensive collection of brief explanations and definitions of concepts and terms in the field of nuclear physics and atomic energy. It will prove valuable to the scholar, researcher, teacher, librarian, student and layman. Individual entries are made for each element, and such data as chemical symbol, atomic number, weight, melting and boiling point, specific gravity, stable isotopes and radioisotopes are given.

Every known member of the radioactive families is indicated, along with descriptive matter on nuclear fission, tracer technique and atomic and hydrogen bombs. Thumbnail biographical sketches of outstanding nuclear physicists and chemists are contained.

Instrumentation

"Industrial Instrumentation," by Donald R. Echman. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Illustrated. 396 pages. $5.00

Technical book on industrial instrumentation reviews the principles of measurement methods employed in processing and manufacturing. Emphasis is placed upon application rather than on individual mechanisms. This text is complete in itself, and no other references are required for a full understanding of the subject.

Primarily for students and the practical field engineer, as only a small portion of the book contains differential equations. The problems are mainly elementary and well explained. Subject matter covered is divided into eleven chapters, and each is concluded with a group of questions.

Some of the important chapter headings are: Qualities of Measurement; Expansion Thermometers; Thermoelectric Temperature Measurement; Mechanical Measurement; Flowmetering and Process Instrumentation.

NEWS . . . of men and companies

Brown Boveri Corp.—Paul R. Sidler, president of the New York corporation was honored recently on the occasion of his completion of 25 years service with the parent organization, Brown, Boveri & Co., Ltd. of Baden, Switzerland. Mr. Sidler was tendered a banquet in his honor at the home office. He came to the United States in 1931 as resident engineer for the firm and became president in 1946.

P. R. Sidler

Dr. Rettaliata

Illinois Institute of Technology—Dr. John T. Rettaliata, dean of engineering at Illinois Institute of Technology, has been named vice-president of ASME. A leading authority on turbine engines and jet propulsion, Dr. Rettaliata is the author of numerous technical articles. He joined the Illinois Tech staff in 1945, becoming dean in 1948.

Industrial Safety Equipment Assoc.—Charles H. Gallaway, sales manager of the Safety Products Div., American Optical Co., Southbridge, Mass., was elected president of the Industrial Safety Equipment Association at the annual meeting held in June. He succeeds Lawrence E. Dickson, president of the Standard Safety Equipment Co., Chicago, who has completed two years in office. E. L. Wheeler, of Wheeler Protective Apparel, Inc., Chicago, was elected vice-president to succeed Gallaway. Stewart N. Clarkson, 420 Lexington Ave., New York, was reappointed secretary-treasurer.

Swartwout Co.—Kenneth P. Hengesbach has been named power plant equipment sales engineer in the company's Philadelphia district office.

Caldwell Industries, Inc.—Election of Floyd Durham as vice-president in charge of production, has been announced by F. M. Caldwell, president.

Farris Stacon Corp.—V. W. Farris has announced the formation of a company to purchase the Edison Stacon Regulating Valve Div. from Thomas A. Edison, Inc. (Instrument Div.). Mr. Farris, who is president of the Farris Engineering Corp. among other enterprises, plans to carry on the manufacture of the regulator and will incorporate numerous new improvements in design and construction. The company has acquired all the Stacon patents, equipment, machinery, inventory and records, and will service present users of Stacon regulators and controllers. Main office and plant of the Farris Stacon Corp. will be located in Palisades Park, N. J.

Borg-Warner Corp.—F. M. Hawley, president and general manager of Morse Chain Co., a division of Borg-Warner, has announced the appointment of J. Nall Candler as his administrative assistant. Mr. Candler was formerly assistant general manager of the Norge division.

Insul-Mastic Corp. of America—The national sales organization has been enlarged with the appointment of four new licensees. Two of these firms, General Building Maintenance Co., 409 Elm St., Buffalo 3, N. Y., and Claude A. Woodard, 2423 East 14th Place, Tulsa, Okla., will be engaged in the application of the company's coatings to the exteriors of homes and commercial buildings. The other two, H. S. Chaffee Co., 220 Scott St., Buffalo 11, and W. F. Magann, 2420 High St., Portsmouth, Va., will make applications in industrial plants.

The Colorado Fuel and Iron Corp.—Richard H. Frizzell has been appointed sales manager of the Structural Products Department of the Wickwire Spencer Steel Div. of The Colorado Fuel and Iron Corp. Mr. Frizzell succeeds to the position of G. L. Crawford, who will devote his full efforts to the position of sales manager of the division's Buffalo sales district.

R. H. Frizzell

B. H. Stolpestad

Crosby Steam Gage & Valve Co.—Birger H. Stolpestad, formerly assistant chief engineer, has been promoted to chief engineer. Mr. Stolpestad has served the Wrentham, Mass., company in its service and engineering departments for 17 years.

Goodyear Tire and Rubber Co.—Two advancements in the Chemical Development laboratories have been announced by Dr. R. P. Dinsmore, vice-president in charge of research and development. Merle E. Wendt, in charge of vinyl

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Stopping and starting of machinery, motors and other electrical equipment cause load fluctuations resulting in equipment slowdown. To speed up slowdowns, install STABILINE Automatic Voltage Regulators to maintain constant voltage.

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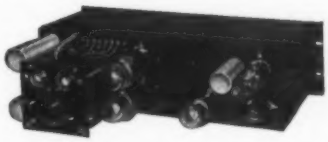

STABILINE TYPE IE operates instantaneously, electronically, to keep delivered voltage to within ±0.1 volts of preset value, regardless of line variations. Holds output to within ±0.15 volts for any load current change or load power factor change from .5 lagging to .9 leading. Waveform distortion *never* exceeds 3%.

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production development service and technical sales service on adhesives and latices, has been elevated to assistant manager of the Chemical Products Development Div. Moving into the position left vacant by Mr. Wendt's promotion is Kermith K. Fligor.

Karl J. Learey, district manager at Atlanta, Ga., for the General Products Div., has been named manager of Airfoam Sales with headquarters in Akron.

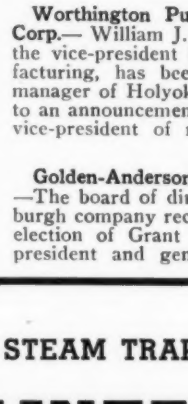
Hyatt Bearings Div.—H. R. Gibbons is now the chief engineer in full charge of product design, research, application and service engineering. He succeeds O. W. Young who is assuming new duties as technical assistant to the office of the general manager.

Eriez Mfg. Co.—The Ponsford-Moos Equipment Co., 516 San Francisco St., El Paso, Tex., has been appointed exclusive sales representative in Panama, Costa Rica, Nicaragua, El Salvador, Honduras and British Honduras for this Erie, Pa., producer of magnetic equipment.

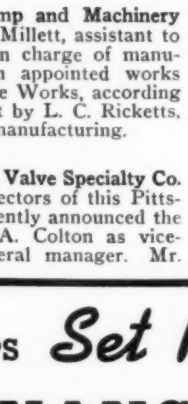
Diamond Alkali Co.— Dr. L. P. Seyb, since 1942 a chemist and group leader in the Research department, has been named manager of research. He succeeds J. E. Underwood, who is relinquishing the post he has held for the past six years to become a research consultant for the company.

Penn Industrial Instrument Corp.—James W. Bennett has assumed the position of general sales manager. For the past five years he has done special engineering sales work for Energy Control Co. of New York and Philadelphia.

Dearborn Chemical Co.—Lester R. Sager has been appointed process manager according to a recent company announcement. He will supervise production planning and the development of process equipment.



L. R. Sager



W. J. Millett

Worthington Pump and Machinery Corp.— William J. Millett, assistant to the vice-president in charge of manufacturing, has been appointed works manager of Holyoke Works, according to an announcement by L. C. Ricketts, vice-president of manufacturing.

Golden-Anderson Valve Specialty Co.—The board of directors of this Pittsburgh company recently announced the election of Grant A. Colton as vice-president and general manager. Mr. Colton has served as assistant manager of the company since 1934. The board also announced plans for a new sales program extending to South America.

United Iron Works—New eastern headquarters at 225 Broadway, New York, were opened August first by the United Centrifugal Pumps, Div. of United Iron Works. The new office is headed by John Re, who has been sales manager for the Oakland, Calif., firm.

Food Machinery and Chemical Corp.—Gerald F. Twist was elected a vice-president of this corporation at a recent meeting of the directors. He is manager of the company's Peerless Pump Div. with major plants located at Los Angeles and Indianapolis.

Cleveland Worm and Gear Co.—Appointment of Lee O. Witzenburg as general sales manager of the Cleveland Worm and Gear Co. and its subsidiary, The Farval Corp., has been announced.

Tube Turns, Inc.—Landis O. Morris, Jr., has been assigned to the staff of Robert S. Tyler, Jr., manager of the Tulsa office.

Dampney Co. of America—Announcement of an expansion of industrial sales representation was announced recently with the appointment of three new agents to handle Dampney products. Boiler Supply Co., 440 Chestnut St., Nashville, will cover central Tennessee. R. E. Mundy Co., 1520 Cleveland, S. W., Roanoke, will serve cen-

NICHOLSON EXPANSION STEAM TRAPS *Set Record*

for **LOW MAINTENANCE**

Here is an illustration of how Nicholson's extreme simplicity is cutting trap maintenance costs. In the 2 years Bradshaw & Co. have been distributing Nicholson expansion steam traps in the Pittsburgh area they have installed 444 units. Not one order for repair parts has been received. And examinations of traps in continuous service for at least 18 months, at steam pressures up to 250 lbs., have shown no valve cutting.

TYPE RF Expansion Steam Trap — Installed horizontally. Both types are for steam or hot water; pressures to 250 lbs.

TYPE SF — Installed horizontally or vertically without supports.

Only One Moving Part. No Pins, Bearings, Links to Wear.

Other features: easily installed; discharge air as efficiently as water; no air binding; hardened stainless steel valve, seat. Lengths, 18" to 40". Press., 0 to 250 lbs. without change of valve or seat.

For All Equipment Using Steam or Hot Water

Radiators	Kettles	Switch Heaters
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Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

tral Virginia and southern West Virginia. In Mexico, Dampney products are to be distributed by Consultores y Abastecedores Industriales, S. A., Dolores 17-301, Mexico, D. F.

Amco Metal, Inc.—The appointment of Alfred D. Jenss as district manager for the company's Cincinnati office has been announced. For the past several years Mr. Jenss has been field engineer of the Milwaukee district office.

Graver Water Conditioning Co.—James T. Potter has been named representative for the states of North and South Carolina. His offices are at 1521 Stanford Place, Charlotte, N. C. For the Atlanta, Ga., territory, Evans L. Shuff & Associates have been named Graver representatives, with offices at 303 Five Ivy Bldg., Atlanta 3, Ga.

Manning, Maxwell & Moore, Inc.—Election of Hamilton Merrill, a former vice-president and director, to the office of president has been announced by Colby M. Chester, chairman of the board of directors. Mr. Merrill succeeds Robert Ross Wason who died July 7, 1950.

MM&M has appointed Erling Klafstad assistant director of engineering for Hancock valves and Consolidated safety and relief valves.

Jeffrey Manufacturing Co.—West Virginia district offices have been moved from Huntington to 403 City Ave., Beckley. E. H. Hebden will continue as manager.

Baldwin Locomotive Works—R. B. Crean, vice-president in charge of Apparatus Sales, has announced the appointment of R. G. Tabors as manager, Hydraulic Press and Power Tool Department.

Also announced was the appointment of Andrew Liston as manager, Hydraulic Turbine and Marine Products Department.

A third appointment, that of Robert S. Oberlander as manager, Diesel Engine Department was made known.

Delta Engineering Co.—Appointment of two distributors of the Delta catalytic combustion process for smoke elimination, slag and fly-ash control, has been announced by J. Fred Stoliker, Delta president.

The C. Reiss Coal Co. of Sheboygan, Wis., will cover Wisconsin, Minnesota, Iowa, North and South Dakota, and the Upper Peninsula of Michigan. Vessels of U. S. Registry on the Great Lakes will be handled by Drummond-Dolomite, Inc., of Sheboygan, Wis., and Cleveland, Ohio.

Illinois Institute of Technology—Harrison D. Goodman has received an appointment as instructor of mechanical engineering at Illinois Tech, according to Dr. Frank D. Carvin, director of the department. Mr. Goodman received his BA at the University of Wisconsin in 1944 and returned to get his BS and masters in ME after World War II.

William E. Thompson, associate research mechanical engineer at Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y., is now an instructor in mechani-

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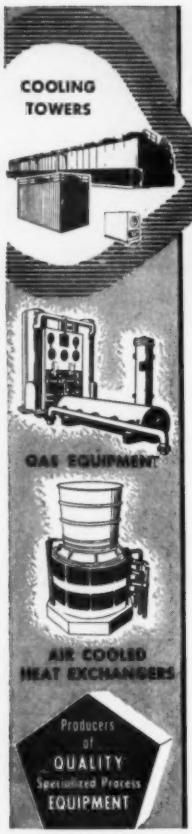
There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction



Pritchard INDUSTRIAL COOLING TOWERS Help You Save Water!

Adequately sized, thoroughly engineered and manufactured of highest quality materials, Pritchard Towers are guaranteed to meet your peak as well as your normal load requirements. Wherever you see a Pritchard Cooling Tower, you see water conservation at work.

Consult your nearby Pritchard representative for the solution to your water conservation problem.

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J.F. Pritchard & Co.
Dept. No. 92 908 Grand Ave., Kansas City 6, Mo.

District Offices:
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Representatives in Principal Cities from Coast to Coast

cal engineering. He was awarded his master's degree in 1949 at the University of Michigan.

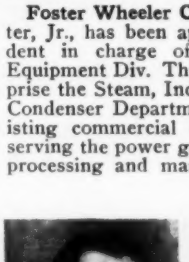
Nickel Cadmium Battery Corp.—Appointment of two new sales representatives was recently announced by A. B. Strange, treasurer and general sales manager. Frank Frable, with offices at 122 South Michigan Ave., Chicago 3, Ill., will serve Illinois, Indiana, Wisconsin and Iowa. Gordon H. Proffitt, whose office is in the Matson Bldg., 215 Market St., San Francisco 5, Calif., will represent all markets for Nicad batteries.

National Radiator Co.—According to Carroll M. Baumgardner, vice-president of sales, the company has opened a Pacific branch sales office at 681 Market St., San Francisco, with Robert E. Daly as branch manager. The new office will be responsible for sales in California, Oregon, Washington, Nevada, Idaho, and Utah. Mr. Baumgardner also announced that Herbert Van Kuran has joined the Seattle sales staff as successor to Mr. Daly.

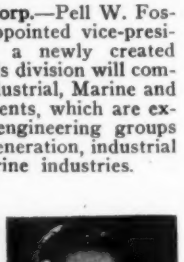
Catawissa Valve & Fittings Co.—Clifford Wood has been appointed Eastern Div. manager. He will headquarter in New York City.

Woodhouse Chain Works—John H. Graham & Co., Inc., New York City, have assumed the position of export representatives for this chain manufacturing concern according to E. S. Washburn, general manager.

Foster Wheeler Corp.—Pell W. Foster, Jr., has been appointed vice-president in charge of a newly created Equipment Div. This division will comprise the Steam, Industrial, Marine and Condenser Departments, which are existing commercial engineering groups serving the power generation, industrial processing and marine industries.



P. W. Foster



D. E. Moorhead

General Electric Co.—Dwight E. Moorhead has been appointed manager of the San Jose Motor Div. of General Electric's Small and Medium Motor Div. He will be responsible for the operation and management of personnel and facilities in engineering, manufacturing, sales, and accounting at the California plant.

B. W. Mahoney has been appointed assistant manager of sales and Max I. Alimansky, formerly assistant manager of engineering, has been named to assume Mahoney's former position as assistant manager of manufacturing for the Transformer and Allied Product Div. at Pittsfield, Mass. T.A.P. Div. manager Robert Paxton called these "temporary" changes which, he said, are in line with the company policy of providing opportunities for executives to learn more phases of the business.

E. F. Houghton & Co.—Two new members were elected to the board of directors at the July meeting. The newly named members are D. C. Miner, advertising manager, and William K. Barclay, Jr., Philadelphia resident partner of Stein Bros. & Boyce, members of the New York Stock Exchange.

D. J. Richards, vice-president—sales, has been placed in complete charge of all domestic and foreign sales activities since the recent death of G. W. Pressell, formerly vice-president and director of sales. Mr. Richards will also act as director of advertising and will supervise the activities of the Product Development and the Sales Development departments.

Research and Development Board—Dr. J. A. Hutcheson, director of research, Westinghouse Electric Corp., Pittsburgh, Pa., will be chairman of the committee on ordnance. Dr. Hutcheson has served on the committee as a consultant for the past two years.

Wheelco Instruments Co.—A new sales office has been opened in Grand Rapids, Mich., that will cover the whole state of Michigan, with the exception of Detroit. R. P. Campbell, sales engineer, will be in charge as assistant district manager. The new office will operate under the supervision of the Detroit district office.

Don C. Walley, formerly sales engineer with the Chicago Western Div. office, has been appointed St. Louis, Mo. district manager. Warren F. Paetz will take over Mr. Walley's former territory of central Illinois and Iowa.

Infilco Inc.—Relocation of the research, development and engineering divisions, as well as the company's general offices took place September 1. These departments and offices moved into temporary quarters at 2750 South Twelfth Ave. in Tucson, Ariz., while a new building is being built to house Infilco's expanding operations. Manufacturing, chemical laboratories, advertising and certain phases of engineering will continue in the present Chicago plant.

Johnson Service Co.—Recent factory personnel appointments announced by this Milwaukee concern include John C. Spangler, chief production engineer; Earl J. Rice, assistant factory superintendent in charge of manufacturing operations and Ralph F. Kubal, assistant production manager for planning and scheduling operations.

J. O. Ross Engineering Corp.—On August 1 the New York office, which has been located at 350 Madison Ave., moved into new and larger quarters at 444 Madison Ave., New York 22.

Standard Transformer Co.—The appointment of two new sales representatives was recently announced by J. S.

Buchsbaum, sales promotion manager. John G. Gaines Co., 2201 Grand Ave., Kansas City 8, has been named exclusive representative for Kansas and western Missouri. E. C. Fones, Jr., 3104 Raymond St., Raleigh, is representative for North and South Carolina.

Bristol Co.—R. M. Brown, formerly sales engineer with the Bristol Co. of Canada, Ltd., and lately instrumentation engineer with Stadler Hurter & Co., Montreal, has rejoined the Bristol Co. in Baltimore, Md.

OBITUARIES

Hammel-Dahl Co.—Bruce A. Irwin, vice-president and general manager, was fatally injured early this summer as a result of an automobile accident. For more than 20 years, he had been actively engaged in the design and development of automatic flow control valve application in the chemical, petroleum and general process industries.

B. A. Irwin

A. H. Timmerman

Wagner Electric Corp.—Arthur H. Timmerman, recently retired vice-president, died in Dallas, Texas at the age of 79. He became ill while on a vacation trip. He had retired March 20, 1950 after 50 years with the company and had been an active member of NEMA, serving on its first board of governors. He had also served the National Metal Trades Association.

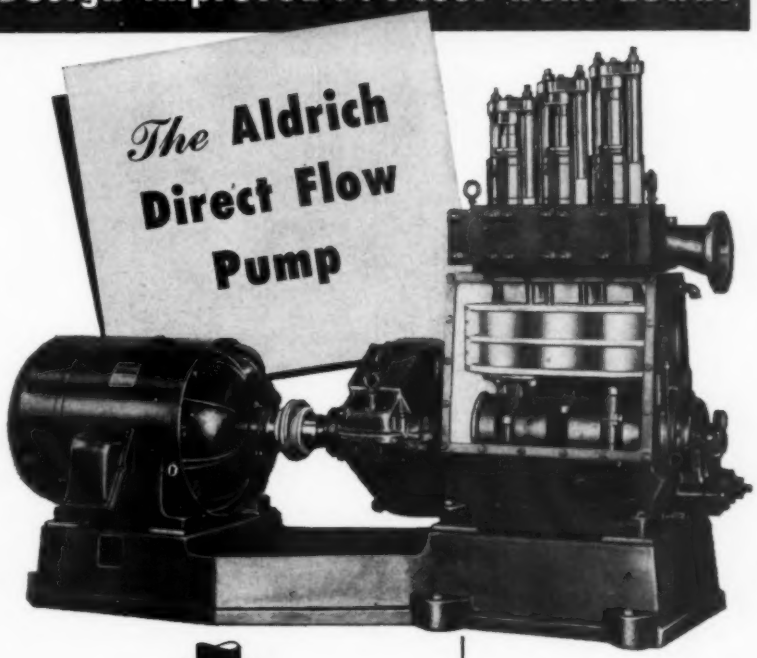
Combustion Engineering—Superheater, Inc.—Arthur Ludt, a contract engineer died recently. Mr. Ludt, in his capacity as contract engineer, had been associated with many large central station projects.

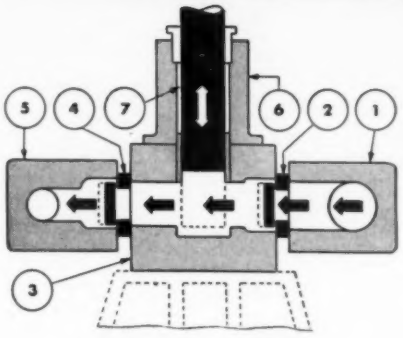
Walsh Refractories Corp. — Albert M. Menzi, 58, secretary of this St. Louis company died July 29. A member of the American Bar Association, he had also served as attorney for the company and was for many years secretary of the Missouri group of the American Refractories Institute.

Blatz Brewing Co.—Hugo A. Doege, 49, credit manager and an employe for 19 years died suddenly July 16 of a heart attack at his home in Milwaukee.

Volco Brass & Copper Co.—Andrew Czapak, chief engineer, died suddenly at his home in Elizabeth, N. J., on July 8. He had been associated with this company for 16 years, and served as a member of the Volco Planning and Management Board.

Design improved . . . cost went down!





Direct Flow Fluid-End Design . . . locating:
(1) suction manifold,
(2) valve assembly,
(3) working barrel,
(4) valve assembly,
(5) discharge manifold,
(6) stuffing box,
(7) plunger.

New to the Aldrich line, this 100 hp reciprocating pump has a through-flow, close clearance design and a sectionalized fluid-end which features extreme simplicity and maintenance economies. One man can easily remove and replace valve assemblies, and fluid-end parts can now be replaced at a fraction of the cost of an entire end unit. Other savings include: interchangeability of wearing parts, less costly pump housing and lower foundation expense. Compared to former units, the price of a new Aldrich Direct Flow Pump is substantially less. Request Data Sheet 64, and check your requirements with Aldrich engineers.

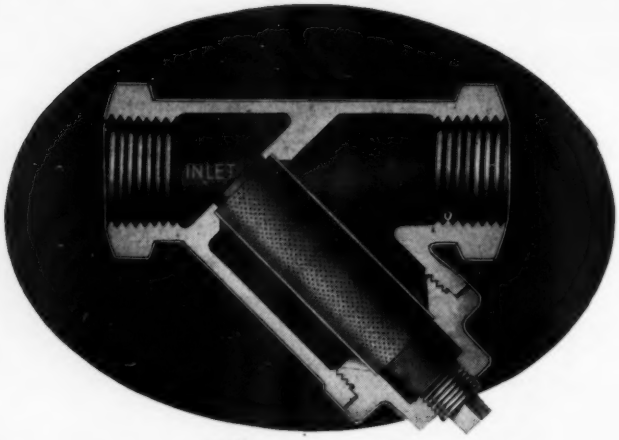
Representatives: Birmingham • Bolivar, N.Y. • Boston • Buffalo • Chicago • Cincinnati Cleveland • Denver • Detroit • Duluth • Houston • Jacksonville • Los Angeles New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa

THE ALDRICH PUMP COMPANY

PINE STREET, ALLENTOWN, PENNSYLVANIA

Export Dept: 751 Drexel Building, Phila. 6, Pa.

All Aldrich Pumps Have **STAYING POWER**



Masoneilan Strainers

Dirt, Chips and other materials . . . Protecting Equipment

Masoneilan Strainers protect pressure regulators, shut-off valves and other apparatus from possible damage by keeping out dirt, chips and other foreign materials. Screen will not leak, or buckle . . . is easily removed for cleaning. It may be installed in horizontal or vertical lines where flow is down. Safeguard your equipment, prevent possible shutdowns . . . install a Masoneilan Strainer ahead of each unit. Sizes from ¼" to 1½" bronze; 2" cast iron, screwed connections; 2" to 4" cast iron, flanged connections; 125 to 250 lb. working pressure.

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Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

NEW BULLETINS

(Continued from page 24)

dimensions, prices and capacities are included in tabular form. Photographs and color drawings accompany the descriptive material. Schutte and Koerting Co.

Fittings (3U). Bulletin describes a complete line of cast-iron, malleable and bronze fittings. Covers recent additions of cast-iron, screwed, flanged, sprinkler and extra-heavy malleable parts. The Kennedy Valve Mfg. Co.

Flexible Rubber Pipe (3V). Applications and comparative qualities of flexible rubber pipe are explained in 8-page bulletin. Economies in costs of installation and maintenance as well as longer life are explored in detail, along with typical case histories and recommended applications. The Hewitt Rubber Div., Hewitt-Robins, Inc.

Hose Fittings (3W). Hose couplings and fittings of various types for handling liquids and gases are described and illustrated in 12-page catalog section. It also gives details on each type, together with specifications, general and maximum pressure recommendations with a description of threads. The B. F. Goodrich Co.

HEATING, VENTILATING AND AIR-CONDITIONING

Blowers (3X). Engineers will find a wealth of fan information in three bulletins recently issued. Forward curved fans are covered in a thorough manner with a host of photos, data, diagrams, charts, performance tables and other valuable information crowding an 80-page book. Backwardly inclined fans are similarly treated in an 84-page book while utility fans are presented in an 8-page booklet. The Trane Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Roof Ventilators (3Y). Vertical discharge roof ventilators for exhausting harmful fumes as high as possible above the roof are described in 2-page bulletin. Contains available sizes and capacities. DeBothezat Fans Div. American Machine and Metals, Inc.

Radiant Glass Panels (3Z). Glass panels with electrically conducting coating fired on the surface, typical applications and engineering properties of these radiant heating panels are presented in illustrated 8-page bulletin. It also contains sizes, rating table and price list. Corning Glass Works.

Air Heaters (4A). Illustrated 4-page bulletin describes applications of direct gas fired air heater for heating operations to 600 F. Discussions on construction features and safety controls are

presented along with dimensional drawings for various models. Gehnrich Oven Div., W. S. Rockwell Co.

MISCELLANEOUS

Rust Problems (4B). Any industry seeking to stop rust's destruction of iron and steel, or to seal and waterproof many other surfaces, should find its special problem well answered in this new catalog. Easily understood directions for general and special uses are given, together with complete specifications. Color chips—at least seventy, plainly designated and reproduced—round out the booklet. Rust-Oleum Corp.

Anticorrosive Paints (4C). Fast drying red lead anticorrosive paints of the vinyl and coumarone types are featured in technical letter that points out advantages of each type. Lead Industries Association.

Laminated Panels (4D). Illustrated 12-page booklet gives complete details of new laminated panels, two inches thick with faces of cement-asbestos board and an inorganic core of insulation. Each standard 4 x 8 ft panel weighs about 200 lb and is incombustible, strong, and offers insulating value as well as dimensional stability, according to the booklet. Also contains installation pictures, construction details and technical data. Kaylo Div. Owens-Illinois Glass Co.

Anti-Rust Paint (4E). Folder lists complete instructions for the use of this anti-rust paint as well as describing heat resisting aluminum paint, chemical resistant black paint and wood preservative paint. Speco, Inc.

Ladder Scaffolds (4F). Aluminum's light weight added to other advantages of the rolling type ladder scaffold is graphically demonstrated in 4-page illustrated bulletin. Available in spans of 6, 8, and 10 ft, the sectional ladder scaffolds can be assembled in various heights. Complete specifications are included. Patent Scaffolding Co.

Casters (4G). To aid in choosing the right caster for any type of service this company has published a caster selector bulletin which, used in conjunction with the catalog, provides ready answers on all matters of proper caster selection. Divided into sections on the various types, each section gives load capacity, type of bearings, wheel diameters and overall height. Complete information on how to use the reference tables is included. Bond Foundry & Machine Co.

Tool Case (4H). Designed for the technician and engineer, this hard vulcanized fiber tool case is described and illustrated in a pamphlet. Manufacturer claims the case enables the engineer to find his tools at a glance and offers a ready tool check on leaving the work. Technical Tool Case Co.

Roll-Up Steel Doors (4J). Data and typical installations of sectional galvanized steel doors are presented in 12-page well illustrated booklet. Although

A job that took 26 MAN HOURS is now done in 3 MAN HOURS with a DRACCO Pneumatic Conveyor

MATERIAL RECEIVED IN BULK INSTEAD OF BAGS ALSO SAVED $150.00 EACH WEEK

● DRACCO Pneumatic Conveyors save money in MANY WAYS. It formerly took 26 man hours to unload a car—with a DRACCO Pneumatic Conveyor it is now done in 3 man hours. A saving of $150.00 each week is also made in purchasing material in bulk, instead of in bags. In addition to the above savings, a dangerous dust hazard was eliminated, and the plant is much cleaner. This installation paid for itself within 2 years. If you handle chemicals, grains, or granular materials, reduce the cost to a minimum with DRACCO Pneumatic Conveyors. DRACCO Engineers have reduced handling costs for over 35 years — why not consult them?

DRACCO
Pneumatic Conveyors
SAVE MONEY

1 Reduce labor cost.
2 No loss of material in handling.
3 No contamination.
4 Eliminates dust.
5 Material received in bulk at lower cost.
6 Low maintenance cost.

For Further Information Write

DRACCO CORPORATION
4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.
DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

A QUICK ECONOMICAL way to clean small tubes

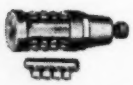
ROTOJET Junior Tube Cleaners offer advantages possessed by no other type. They are light in weight, fed easily with the hose, and shifted quickly from tube to tube.

The ROTOJET Motor is unusually powerful and efficient. It has only two moving parts, a shaft and a paddle. Positive contact, maintained between paddle and Rotocentric (egg-shape) bore cylinder, assures an undivided air stream and freedom from power loss. An air valve permits one-man operation. Models for straight and curved tubes .495" I.D. up. Water-driven models for tubes .953" I.D. up.

ROTOJET size, speed, and ease of operation offer a marked contrast with external cleaners costing many times as much. Send for new bulletin.

Roto Heads are economical

Roto Heads meet practically every cleaning need. Expanding brushes and scrapers have inexpensive replaceable elements for economical operation.



Expanding brush, ball joint, replaceable brush element.

Expanding scraper and replaceable element.

Wire brush and adapter.

Sectional wire brush.

ROTOJET *Junior* TUBE CLEANERS

ELLIOTT COMPANY-ROTO DIVISION

156 Sussex Avenue **Newark 1, N. J.**

general specifications and descriptions are included, doors can be furnished in any practical size and arranged for manual, mechanical or motor operation. Available are sections fabricated with glass window inserts or with replaceable spun-glass filter inserts. The Kinnear Mfg. Co.

Machining Aluminum Bronze (4K). Recommended practices for the machining of all grades of aluminum bronze alloy as well as tool design, inspection and a conversion table to be employed in the machining of weld deposits is covered in 12-page bulletin. Photographs and drawings illustrate the book. Ampco Metal, Inc.

Floor Maintenance (4L). File folder contains four manuals for treatment and maintenance of most any type floor—new or old. Titles are: "Handy Maintenance Manual," "Proper Treatment of Terrazo or Cement Floors," "Floor Treatment and Maintenance and Job Specifications." In addition, the folder itself presents maintenance data in capsule form. Hillyard Chemical Co.

Corrosion Resisting Cements (4M). The use of corrosion resisting cements to repair cracked, corroded and broken pipe, pumps, valves and other mechanical equipment in corrosive service is shown in 2-page bulletin. Carboline Co.

Rigid Glass Insulation (4N). The complete story on normal temperature (50 to 150 F) applications of rigid, lightweight glass insulation is covered in 36-page booklet. Included are technical data, facts about accessory materials, and description of a new line of trowel finishes. Pittsburgh Corning Corp.

Metal Inspection (4P). The dye penetrant method of inspection for every kind of metal is described in circular that gives the simple steps required in this chemical process. Dy-Chek Co. Div. Northrop Aircraft, Inc.

Locomotives (4Q). Line of gasoline, diesel and diesel-electric locomotives ranging from 2½ to 75 ton in both standard and narrow gage is described in 44-page bulletin. Sizes, types available, specifications and capacities are shown. Plymouth Locomotive Works.

Mask Phone (4R). Sound powered direct telephone contact between wearers of gas masks or breathing apparatus is described and illustrated in 2-page bulletin. Mine Safety Appliances Co.

Polyester Resins (4S). Complete data on solutions of polyester resins in styrene are presented in a new 24-page booklet. Also contains tables and charts that define the properties of different types; recommends techniques for blending, laminating, compounding and curing; discusses the use of fillers, pigments and dyes in addition to suggestions for application. Rohm & Haas, Resinous Prods. Div.

Nickel Alloys (4T). Completely revised so as to be essentially new are two technical bulletins on the properties of high nickel alloys. 24-page publications are complete with illustra-

tions, tables and graphs. They describe the engineering properties of Iconel, Inconel "X", "K" and "KR" Monel. The International Nickel Co., Inc.

Corrosion Prevention (4U). Metallized zinc or aluminum protective coatings are briefly described in 4-page bulletin that also contains general information on their uses and applications. Metallizing Engineering Co., Inc.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Impact Shock Material (4V). To explain the properties and functions of this unique material and to describe its more widely developed applications, the manufacturer has published a 36-page booklet. Data are presented in a form readily understandable, a discussion of impact shock, transmitted high-frequency vibration and noise, and the reduction of their destructive effect. Fabreeka Products Co.

Metalworking Lubricant (4W). The use of colloidal graphite in metalworking is the subject of a generously illustrated, 2-color, 6-page bulletin. Specific instructions are given for the use of four different types of dispersions in various phases of metalworking, as well as graphs that show the results of test runs. Acheson Colloids Corp.

Industrial Aprons (4Y). Featured in this 4-page catalog section are descriptions and illustrations of the three types of Koroseal aprons, the acidproof, film and heavy duty. Also covered are various aprons made of different types of rubber, together with specifications and recommendations for their particular use. The B. F. Goodrich Co.

Matting (4Z). Three new catalog sections describe and illustrate 8 different types of runner matting made of rubber and other materials. Specifications are included as well as various applications. The B. F. Goodrich Co.

Fireproof Door (5A). Colorful and informative 4-page brochure complete with test photos describes new wood-faced fireproof door. The door has a fire rating from Underwriters' Laboratories for Class B and C openings. Kaylow Div. Owens-Illinois Glass Co.

Box Car Unloader (5H). Full description complete with photographs and cutaway drawings features 4-page bulletin covering a recently developed machine. The unloader is said to handle practically all bulk materials, up to 2-in. lump. Stephens-Adamson Mfg. Co.

Metallizing (5J). New self-bonding metallizing material is featured in 4-page illustrated bulletin. Describes quick 3-step process that is said to provide super-hard, oil holding, bearing surfaces. Contains user reports as well as suggested applications. Metallizing Engineering Co. Inc.

STANDARDAIRE

Precision Built Axial Flow

BLOWERS handle the movement of air gently by screw action instead of paddle action, as is the case with other positive displacement blowers. Result—air pulsations and noise are reduced to a surprisingly low level. In Standardaire Blowers the revolutionary new form of the rotors marks a major improvement in blower design. The rotors are produced by an exclusive rotary generating process, the form and helix being controlled entirely by the machine gears. This produces rotor threads that are accurately shaped and machined to close tolerances for efficient blower operation. The design of the rotors and other construction details makes possible internal compression to a degree that Standardaire Blowers operate on a modified adiabatic cycle with a lower mean internal pressure. This important feature, together with advanced engineering throughout, makes for a quiet, compact, efficient blower with long service life.

Write for Standardaire Blower Bulletin covering dimensional information. Publication No. 88.

The Standard Stoker Company, Inc.,
Dept. C-9, 370 Lexington Ave.
New York 17, New York

Standardaire Blower equipped with unique pulley attachment for belt drive, when required.

THE STANDARD STOKER CO • INC •

Standard Stoker

NEW YORK • CHICAGO • ERIE • MONTREAL

POWER PLANT GENERATING EQUIPMENT FOR SALE

250 Kilowatt — In Good Condition
Priced to Sell or Best Offer

One MOORE STEAM TURBINE, 10.5 x 10.5, with 4800/1200 RPM reducing gear, No. G-3533 — Connected to —

CROCKER WHEELER 1200 RPM GENERATOR, 250 KW, 1000 Ampere, 250 Volt, D. C. No. 758751.

* * * * * * *

One AMES 4 CYLINDER STEAM ENGINE, 12 x 14, No. 513783 — direct connected to — CROCKER WHEELER 360 RPM GENERATOR, 250 KW, 1000 Ampere, 250 Volt, D. C.

* * * * * * *

AUXILIARY STEAM TURBINE EQUIPMENT:

One WORTHINGTON CONDENSING UNIT, size 337, Ser. 968531.

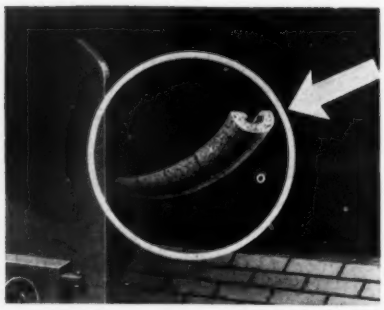
One CONDENSING WATER CIRCULATING PUMP with General Electric Motor — 30 horsepower, 220/440 volt, 3 phase, 1760 RPM, 60 cycle.

One CONDENSATE PUMP with Master Electric Motor — ½ horsepower, 230 volt, D.C., Ser. 963556.

One WORTHINGTON STEAM EJECTOR, size 3-CHP-1HG-ABS. Ser. 968520.

W. B. CONKEY CO.
Division of
Rand McNally & Company
Conkey Boulevard — Hammond, Ind.

Is Your HRT Boiler Worth Saving?



Whether old or new, every riveted HRT boiler needs seam protection. Otherwise, the lapped edge of the plate is sure to bulge and burn.

National Seam Protectors have averted costly maintenance and repairs on hundreds of HRT boilers since 1916. In fact, many a boiler would have been scrapped long ago except for National seam protection.

If you want to avoid leakage, calking, patching, and possible explosion, get complete information on National Seam Protectors. Write now while the subject is on your mind.

NATIONAL BOILER PROTECTOR CO.
928-9 Rybold Bldg. • Dayton 2, Ohio

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 16)

can be used for sealing, waterproofing, patching, caulking, resurfacing and filling such as repairs to tanks, patterns, castings and machinery. Also offered, Fixx-Fab, is a fabric that acts as a filler and support for cold solder in larger areas. Fixx-Sol is the solvent used for thinning the solder and for cleaning and degreasing surfaces. All three items are available in a kit with rubber squeegee for easy application.

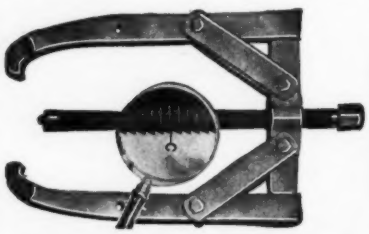
330—EXTENSION-CORD REEL

Industrial Products Co. announces a new heavy duty cord reel carrying UL approval. Furnished with either 24 ft or 45 ft of heavy duty rubber covered cord, reel is available with various types of regular and vaporproof hand lamps at the cord end. It

has a constant retracting speed, and free moving swivel mounting prevents binding. Special design outlet keeps cord free of dirt and grease. The unit is totally enclosed and has sealed-in lubricant. Equipped with universal bracket for ceiling or wall mount.

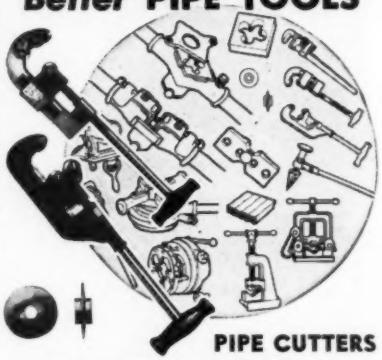
331—PULLERS FEATURE IMPROVED GRIP

Grip-O-Matic pullers with a patented gripping feature, thin jaws and extra strength are manufactured by the Owatonna Tool Co. They are recommended for every use from ignition and electrical work to heavy maintenance jobs. Each size is auto-



matically adjustable by the linkage arrangement. They are safe, will not slip off the work and the Power-Pitch threads on the forcing screw provide 32% more power. There are 14 sizes in both two jaw and three jaw types ranging from 3¼ to 36 in.

ARMSTRONG BROS.
Better PIPE TOOLS



PIPE CUTTERS

"ARMSTRONG BROS." Three Wheel and Standard wheel and roller Pipe Cutters are quality cutters throughout . . . built to give years of good service.

"ARMSTRONG BROS." drop forged Pipe Cutters are built for lifetime service with 1-piece drop forged steel heat treated body and a replaceable hardened steel nut to take up the wear and thrust of handle screw. Used either as 1-wheel (with 2 rollers) or 3-wheel (for close quarters).

"ARMSTRONG BROS." Knife Blade Cutter Wheels are machined from special alloy tool steel properly heat treated. They cut rapidly and easily, hold their keen edge.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5237 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

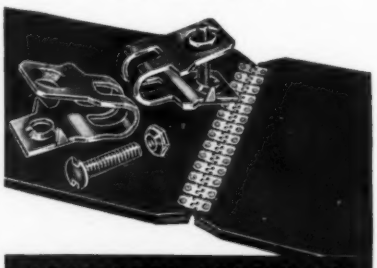
HINGED PLATEGRIP
BELT FASTENER No. 500

For Heavy Conveyor Belts of changing length

These heavy-duty belt fasteners make a strong, flexible joint in conveyor belts, belts of any width and of from ⅜" to ½" thickness. They offer special advantages in mines, quarries or industrial set-ups where length or position of belt is frequently changed, because sections can be removed or added at will. Joints are opened for this purpose by simply pulling out the hinge pin.

Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

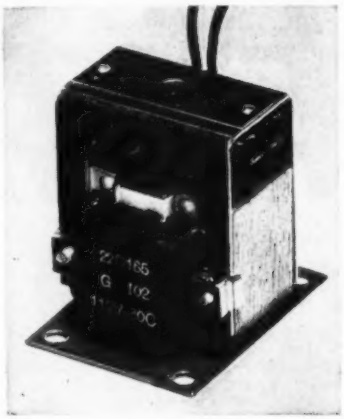
Write for Circular.



ARMSTRONG-BRAY & CO.
5376 Northwest Highway CHICAGO 30, U. S. A.

332—SOLENOID DESIGNED FOR QUIET, LONG LIFE

Short-stroke solenoid for heavy-duty industrial applications has been announced by General Electric's Control Div. It features a cast-permafil coil assembly and in comparative life tests, the new solenoid operated millions of times before failure. The



paper-layer-wound coil is a type that holds the voltage between turns to a minimum. Originally designed for high-speed, pilot-valve operation, the solenoid is ideal for any heavy-duty application requiring a push-type solenoid with strokes of 1/8 in. or 5/16 in.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

333—SMOKE CONTROL BY PHOTOELECTRIC SCANNER

Combustion Control Corp. announces a new series of smoke indicators. They continuously indicate the density of smoke passing through the stack of a power plant and signal when it exceeds a predeterminel

value. They are adjustable beyond requirements of all smoke ordinances. The alarm can be set to operate at any smoke density value, and meter reading is independent of alarm setting. Operating range is 20 ft max between light source and scanner.

NON-FLUID OIL
TRADE MARK REGISTERED

Provides Positive Lubrication Upon Split-Second Demand

NON-FLUID OIL provides positive lubrication upon split-second demand because it does not require softening by frictional heat before it will feed and reduce friction.

Production goes up and lubricating and maintenance costs go down with NON-FLUID OIL — because it lubricates instantly until entirely used up, and does not drain away from bearings when machinery is stopped.

Send for instructive bulletin and free testing sample of NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 MADISON AVENUE, NEW YORK 17, NEW YORK
WORKS: NEWARK, N. J.

WAREHOUSES: Atlanta, Ga. • Birmingham, Ala. • Charlotte, N. C. • Columbus, Ga. • Greensboro, N. C. • Greenville, S. C. • Chicago, Ill. • Detroit, Mich. • Providence, R. I. • St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Accurate Flow Control
Quick Shut-Off

Air Diaphragm Control
Hydraulic Control
Electric Motor Control
Hand Wheel Control

ROCKWELL
BUTTERFLY VALVES
for Air · Gas · Liquids · Solids

Whether it's by manual control or remote, automatic control, these valves provide efficient, positive, uniform flow regulations at any desired, visible degree of valve opening. When entirely open, valve area is practically as free as the pipe line itself, without bends or seats to cause undue pressure drop or turbulence.

Construction — of any desired metal. Pipe sizes—to 72". Operating pressures—standard, to 25 p.s.i., special, to 125 p.s.i.

Write for Bulletins

W. S. ROCKWELL COMPANY
230 ELIOT STREET • FAIRFIELD, CONN.

COMING SOON!

Outstanding presentation of equipment for production and utilization of steam, electric, and mechanical power

— for YOUR benefit —

19th NATIONAL POWER SHOW

NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

GRAND CENTRAL PALACE, N.Y.

NOV. 27 to DEC. 2

featuring:

- Over 300 informative displays and interesting demonstrations of latest developments for improving power production and utilization.
- Hundreds of new cost-saving ideas on design, installation, operation, maintenance, modernization, and expansion.

Discuss your problems and future plans with exhibitors' technical experts.

Plan to Attend—You'll Be Glad You Did!

Auspices A.S.M.E. in conjunction with Annual Meeting

Management International Exposition Co.

334—BUSHED LINK IMPROVES ROLLER CHAIN

Bushed center plate connecting link, developed for use with Diamond multiple-strand roller chain for severe service is made by Diamond Chain Co., Inc. The same ease of connecting and disconnecting the chain

as with slip-fit center plate links is provided. Connectors are being produced for ¾ through 2½ in. pitch, multiple-strand roller chains and have file-hard bushings pressed into pitch holes of pairs of center plates.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

335—PHOTOELECTRIC TESTER CHECKS OIL QUICKLY

Photoelectric tester that measures the contamination of automobile and diesel crankcase oils has been announced by the Photovolt Corp. Measurements are made through

a layer of undiluted oil of definite thicknesses between glass plates. Results are immediately read on the meter scale and may cover the complete range from .001 to 1.0% carbon.

336—PROPANE ENGINES ARE AVAILABLE

A complete line of commercial engines to operate on propane fuel was announced by Fageol Products Co. It consists of four different models of from 162 to 250 bhp built around one basic design with all major parts interchangeable. These engines are the first

production units for use with 125 octane propane. Savings up to 40% over gasoline or diesel oil are reported. The 10 to 1 compression ratio (15 to 1 is available) is made possible by a combustion chamber which permits higher compression without increasing bearing loads. Controlled turbulence prevents accumulation of carbon deposits.

Performance and efficiency are above highest automotive standards, it is said. For Model 180 (404 cu in.) it is listed at .433 and engine weight per bhp is only 5.43 lb. Engines are available for horizontal or vertical mounting, right or left hand installation, either rotation.

337—ELIMINATES HEAT LOSS IN DRY KILNS

A mica-like mineral, vermiculite, mined and processed by the Zonolite Co. and used instead of sand in the concrete mix, results in an insulating concrete roof slab which will prevent the escape of heat from the kiln. The low heat capacity of vermiculite is responsible for its insulating value. A vermiculite slab is usually cold to the touch due to millions of tiny air spaces in the mineral. The slab is usually applied 3 to 6 in. thick over the existing roof. Roofing material is then applied. Vermiculite concrete weighs only 25 to 35 lb per cu ft in contrast to 150 lb for ordinary concrete.

338—PHOTOELECTRIC COUNTER FOR ALL APPLICATIONS

Photoelectric counter set P2C is one of several new combinations offered by Photoswitch Inc. It consists of photoelectric control with phototube and light source located in small remote housings. Practically all counting problems can be handled by at

least one of the combinations. Speed of operation is up to 600 counts per min and operating range is 10 ft between photoelectric unit and light source. Special light sources are available for longer range.

339—FEEDWATER SOFTENED BY HOT ZEOLITE

Boiler feedwater can now be treated by the Hot-Z system which combines advantages of both hot process and zeolite process, according to Worthington Pump and Machinery Corp. Development of a styrene base resinous zeolite suitable for hot treated water makes it possible to combine hot process treatment with its deaerating and silica reduction features with zeolite softening which assures uniform hardness reduction

SAVE COOLING WATER

Get Many Other Benefits and Cost Savings

● Niagara Aero Heat Exchangers provide faster and more accurate cooling to specified temperatures for liquids in many industrial processes. They help lower production costs.

Cooling by the evaporative principle, they transfer heat to air, which is easily disposed of, and consume less than 5% of water used in conventional cooling methods. A Niagara Aero Heat Exchanger replaces both shell-and-tube cooler and cooling tower, and saves piping and pumping. Its savings quickly return its cost.

It helps improve the quality of production by removing heat at the rate of in-put, and by greater accuracy of control. For example, as applied to heat-treat quenching or to a chemical process cooling, provision for heating as well as cooling saves the time and prevents the product losses of a "warm-up" period.

Successful applications also include control of temperatures for jacket coolants for engines, hydraulic equipment, transformers and electronic sets, and special industrial equipment.

Write for Bulletin No. 96

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities

INDUSTRIAL COOLING • HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Safe all the Way
One of a series of typical Propane Truck Loading Racks
CHIKSAN Style 50-5 Counterbalance Swivel Joint
OKADEE L.P.G. Valve
WECO Wing Union
WECO Hi-Speed Thread Seal

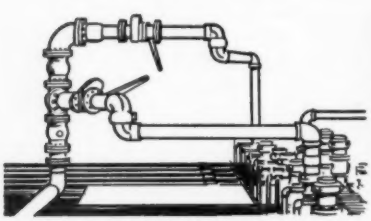
Eliminate *all* the weak spots in your L. P. G. loading racks! Use CHIKSAN *Ball-Bearing* Swivel Joints, WECO Wing Unions, *Okadee* Valves and WECO *Hi-Speed* Thread Seal...and get *matched* safety all the way... plus dependable performance, low maintenance cost, easy handling and long life.

Wherever you handle liquids, vapors or gases through flexible lines, this engineered combination saves you time and money. CHIKSAN Engineers will gladly assist you in designing flexible lines for the safe handling of a wide range of products...in any length...any size...any pressure to 15,000 psi.

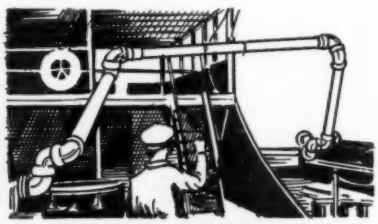
REPRESENTATIVES IN PRINCIPAL CITIES

SOLD BY LEADING SUPPLY STORES EVERYWHERE

Play safe *all the way!* Use CHIKSAN *Ball-Bearing* Swivel Joints to make up your loading and unloading lines. With them, you get unlimited flexibility with the strength, long life and safety of steel. You get greater protection...greater safety ...and greater economy with CHIKSAN.



Transfer lines using CHIKSAN *Ball-Bearing* Swivel Joints save cost of extra valves and fittings...eliminate contamination losses.



CHIKSAN ALL-METAL Marine and Barge Hose is easier to handle...safer...and more economical. CHICKSAN Aluminum Hose is lighter, too.

WRITE FOR CATALOG NO. 50

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY

AND SUBSIDIARY COMPANIES

Chicago 3, Ill. BREA, CALIFORNIA Newark 2, N. J.

WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS

CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

to 0.2 ppm without excess sodium alkalinity.

Temporary hardness is removed by lime and zeolite treatment while zeolite removes the permanent hardness. This in effect substitutes zeolite salt regenerant for more expensive soda ash, and the salt regenerant also replaces most of the expensive phosphate customarily used.

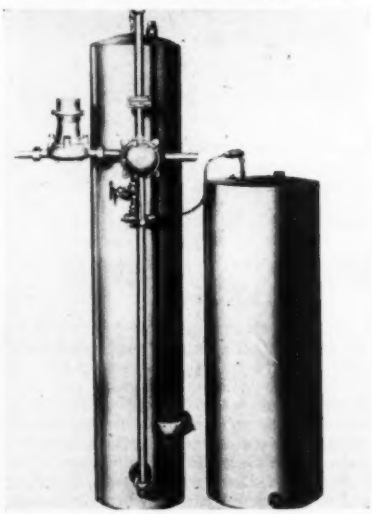
340—COMPRESSION COUPLINGS MADE FOR 8-IN. PIPE

Pipe couplings for pipe sizes up to 8 in. are announced by Morris Coupling and Clamp Co. for both their standard zinc coated steel and their aluminum coupling lines. They are used for permanently joining plain end or threaded pipe, or a combination of the two. The coupling is the compression band type and serves to hold the entire surface of the joint in compression, giving each joint the advantage of a pipe union. Rubber base gaskets are standard equipment, but gaskets of various other types are available.

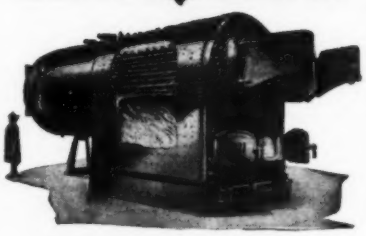
341—SMALL ZEOLITE WATER SOFTENER

Small zeolite water softener for use where requirements are under 100 gpm is announced by Cochrane Corp. The softener is supplied in two groups and in single and double units. Group I comes in 12, 18, 24 and 30 in. tank dia, and group II in 36, 42 and 48 in. tank dia. If a continuous supply of softened water is mandatory, the double unit softener is recommended.

Various types of zeolite—high and low



KEWANEE®
HEAVY-DUTY



10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 96-D9 749
for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

PURE WATER

MAKES FRIENDS *and* LOWERS COSTS

General Filter Co.
SOLVES WATER PROBLEMS

GFC and Layne engineers work closely with municipal and industrial officials for the fast, economical elimination of water treatment problems.

This complete service includes each step from the original survey of the problem to the installation of water purification equipment in the plant.

GFC is part of the nation-wide Layne organization with engineering and construction facilities in every area. Write for detailed information.

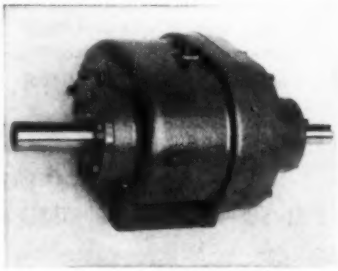
A Layne Affiliate
GENERAL FILTER CO.
923 2nd St. • Ames, Iowa

exchange green sand, synthetic gel and resinous—are offered. Single control valve greatly simplifies operation, requiring little, if any, technical knowledge on the part of the operator.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

342—TWO-SPEED AUTOMATIC TRANSMISSION

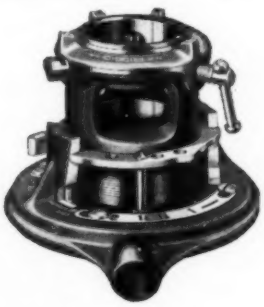
Twenty hp transmission, with a minimum input speed of 900 rpm, is announced by Western Mfg. Co. Two over-running clutches, one engaging in a clockwise and the other in a counter-clockwise direction,



are so arranged that by reversing the motor, two speeds, direct motor speed and a preselected reduction, are provided without changing direction of rotation of output shaft. In the 20 hp model, the low limit of reduction is 6 to 1. Other models are available for 5 to 50 hp motors.

343—PIPE THREADERS ARE JAM-PROOF

An improvement in pipe threaders has been announced by The Ridge Tool Co. The

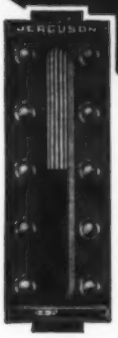


Ridgid 65R self-contained threader is now jam-proof because a new design drive plate automatically kicks out the driving ratchet pawl when standard length thread is cut. Also available is the new jam-proof drive plate which can easily be put into present 65R threaders.

344—ION EXCHANGE RESIN ADDED TO SERIES

Medium-capacity cation exchange resin, designated as Amberlite IR-105G, is announced by the Resinous Products Div., Rohm & Haas Co. IR-105G, replacing IR-100

NEW Coating Treatment Gives You
CLEAREST VISIBILITY over long period of time, with
JERGUSON GAGES



Another "First" for Jerguson that gives you a real plus value when you install Jerguson Gages

YOU can get Clearest Visibility over a long period of time with Jerguson Gages, for Jerguson is now coating all gage glasses with a new special compound that maintains improved visibility.

Jerguson gage glasses are far superior with this new treatment. They are far less subject to fouling through foreign matter adhering to the glass; and viscous liquids are largely prevented from hanging up, thus greatly improving the observation of the true liquid level. You get the advantage of another "First" in a long series of advancements by Jerguson.

Jerguson Gages are Easier to Service

All gaskets are treated with a special compound which *prevents adhesion to glass or metal* under high pressure or high temperature. Glass and gasket replacements are easily made without damaging seats through scraping.

Write for Data Units on Jerguson Gages and Valves.

JERGUSON
Gages and Valves for the Observation of Liquids and Levels
JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under JERGUSON

FOR EVERY SIZE INDUSTRIAL CLEANING JOB, THERE'S A HOFFMAN HEAVY DUTY Vacuum Cleaning System!

5 H.P. HOFFCO-VAC #50 PORTABLE

Improved design for high capacity, continuous cleaning. Operates two 50-foot lines of 1½-inch hose simultaneously, or one 75- or 100-foot length of 2-inch hose. 7½ cubic foot dust capacity – 48 sq. ft. of dust bag area. Write for Bulletin A-794.

NEW! GAS-ENGINE POWERED HOFFCO-VAC #50 PORTABLE

Complete independence of power sources enables this model to operate where ordinary cleaners could not be used. Provides all of the outstanding features of the electric motor-driven model, above, except that power unit is a 4-cycle, single cylinder, heavy duty air-cooled gasoline engine rated at 6.8 H.P. (5.4 continuous). Write for Bulletin A-803.

1½ H.P. HOFFCO-VAC #15 PORTABLE

Brand new heavy duty model with famous Hoffco-Vac ruggedness built into a compact, efficient design. Operates 35-foot length of 1½-inch hose. Provides maximum maneuverability for one-man handling in narrow, congested areas. Write for technical bulletin.

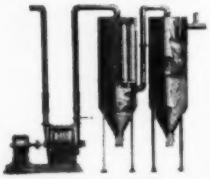
3 H.P. HOFFCO-VAC #30

Unequalled efficiency and economy for its size. 4.4 cubic foot dust storage. Operates 50-foot length of 1½-inch hose. Write for Bulletin A-752.

7½ H.P. HOFFCO-VAC #75

Provides higher suction for extra-heavy duty cleaning and maximum cleaning efficiency with simultaneous use of two 1½" hose either 25, 50 or 75 feet long. Or, 2" hose, 25, 50, 75 and 100 feet long. Write for details.

STATIONARY SYSTEMS IN SIZES 3 TO 100 H.P.



Permit cleaning in several areas simultaneously. Dust is conveyed pneumatically through flexible hose coupled to convenient inlet valves in a permanent piping system. Central collection for easy disposal. Widely used on production operations as well as on plant cleaning.

WRITE FOR BULLETINS AND FREE SURVEY!

AIR APPLIANCE DIVISION

U.S. HOFFMAN MACHINERY CORPORATION

100 EAST 42nd STREET, NEW YORK 3, N.Y.

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO. LTD., NEWMARKET, ONT.

and IR-105, is a phenolic type resin furnished in granular form, for improved hydraulic characteristics. Its high regeneration efficiency adapts it particularly to hydrogen cycle operation, making it especially useful in deionization and split-stream de-alkalization. In the sodium form, the resin is also suitable for water softening.

345—LIQUID CASEHARDENS CONCRETE FLOORS

Concrete floor treatment, called Flintcrust Liquid, is now available from the Flexrock Co. A concrete floor may look

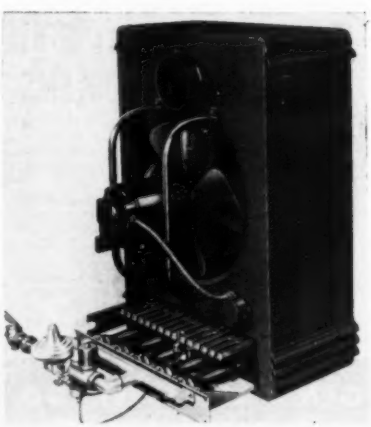
smooth, but the surface presents tiny "hills and dales" as shown by the 16x photo. The tips are quickly ground off by traffic, exposing the softer under-surface, and water, oil, grease, acids, and alkalies penetrate through the pores.

Flintcrust Liquid is flushed over the floor and makes the surface up to ten times harder. It fills the pores, hardening into a glass-like seal.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

346—GAS-FIRED UNIT HEATER

The Trane Co. announces a line of gas-fired unit heaters engineered for efficient combustion of natural, manufactured, mixed or liquid-petroleum gas. The unit's heat generator includes burner heads and mixing tubes of one-piece cast iron construction. Burners, pilot and control valves are combined in one drawer-type assembly. There



are no gaskets; joints are leakproof. Safety switches are incorporated and a room thermostat controls the fan. The heaters are produced in 7 sizes with capacities from 50,000 Btu/hr to 210,000 Btu/hr input and 700 cfm to 2700 cfm.

347—TIME DELAY RELAYS HAVE ADJUSTABLE DIALS

Adjustable dials, now available for the time delay relays manufactured by A. W. Haydon Co., are especially useful for appli-

cations necessitating frequent change of time settings. The time can be changed easily, but once set, it is positively locked. Relay design allows for the addition of radio interference filtering and a governed motor on d-c models. Clutch holding contacts for a push button start can be supplied on either the a-c or d-c models.

348—SLIP CLUTCH PREVENTS OVERLOADING

Slip clutch device which prevents their Circle Ess power shaft from being damaged

by overloading has been designed by F. W. Stewart Mfg. Corp. This device disengages the cable and stops the shaft and tool from rotating on all overloads. The moment the load is normal, cluch re-engages cable.

349—COMPACT HOIST HAS 4-TON CAPACITY

Wright Hoist Div. of American Chain & Cable Co., Inc., announces a line of hand hoists in capacities from ½ to 4 tons with

an unusual degree of safety, efficiency and portability. They are compact for close headroom, lightweight and easy to handle in tight places. Modern gear drive, Weston

IT'S EASY TO MOVE A SCHRAMM AIR COMPRESSOR!

When your plant layout changes . . . or you need an air compressor in a different building . . . the quickest way to transfer and make installation is to use Schramm Air Compressors. They are compact and easy to handle because compressor and motor are mounted as a single unit on a substantial steel base, which also serves as a foundation.

In addition to easy handling and installing, Schramm Air Compressors are vibrationless and built for heavy-duty twenty-four hour service. There is only one price tag on a Schramm.

For your many compressed air jobs about the plant, specify SCHRAMM—and save. Write for folder STF-50.

A complete assortment of Schramm accessories essential to modern industrial installations including after-coolers, moisture separators, air controls and other accessories, is available.

SCHRAMM INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

SPECIALISTS in PIPE FABRICATING

TO MEET THE MOST EXACTING SPECIFICATIONS

Butt Welds • Bending All Types • Coiling
Machining • Threading • Beveling • Lining
Pickling • Galvanizing • Sand Blasting • Preheating • Stress Relieving • Testing.

PIPE — Wrought Iron — Steel • Structural Cast Iron
Copper Steel • Seamless • Electric Weld Spiral, Lap
Butt Weld • Shore Dredge • SPEED-LAY.

PILING — Sheet piling, lightweight —Tubular—all size.

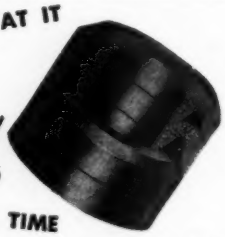
PILE FITTINGS — All types and sizes for steel and wood.

For Oil, Chemical, Concrete, Asphalt and other Industrial Requirements, ALBERT "Rings the Bell."

ALBERT
PIPE SUPPLY CO.
BERRY AT NORTH 13th STREET
BROOKLYN 11, N. Y.

EVERY WAY YOU LOOK AT IT

PALMETTO Pyramid®



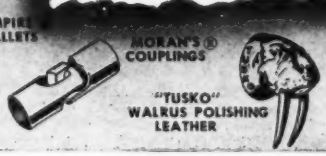
LOWERS YOUR DOWN TIME

Total up the man-hours lost in frequent repacking —or in equipment failure due to faulty packing . . . you'll discover the economy of selecting Palmetto first. The Pyramid is typical.

- Not one, but many styles — fabric and binder varied to match your service condition. That means dependable, tailored performance.
- Uniform, heavier wall construction. Each ring sits squat and true . . . will not split at the hinge . . . no raw edges to fray. That means longer life, sturdier performance all the way.

Write for all the facts. Bulletin MP-20 yours for the asking.

GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA



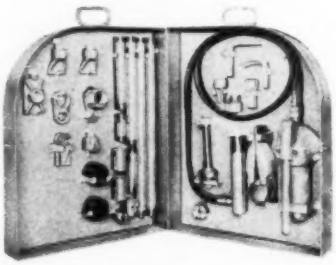
Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

type brake, steel load chain, steel housing, self-lubrication, and drop forged top and bottom hooks are featured.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

350—PORTABLE JACK PROVIDES VERSATILITY

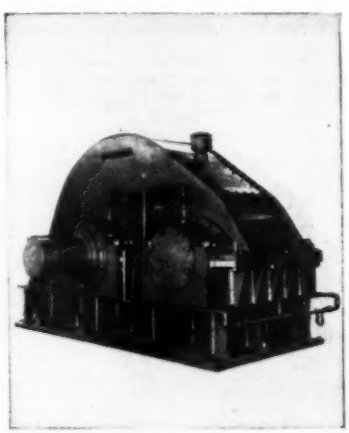
Powered by a 3-ton hydraulic jack with specially designed attachments, the H. K.



Porter, Inc. Hydro-Midget industrial unit provides flexible, controlled power for pushing, spreading, lifting, bending or straightening. With chains, hooks, toes, rubber bases, etc., innumerable special jobs can be completed quickly. Pump and reservoir of this remote control type jack are separate from the ram but connected by flexible, high pressure, oil-proof rubber hose.

351—HEAVY-DUTY SPEED REDUCERS

Single- and double-reduction speed reducers in ratings up to 3,000 hp are available from Westinghouse Electric Corp. BPT taper-hardened gearing and pinion shafts, and fabricated steel housings are used in both types. Gearing is of the standard AGMA



hobbed double-helical type, with a high helix angle. This type gearing minimizes thrust against either case walls or bearings and assures uniform tooth loading and wear.

Antifriction bearings with splash system lubrication are incorporated in the design. Housings are fabricated of rolled steel sections which form box type bases, while wide flange I-beams, interlocked and welded, provide maximum rigidity.

"For high dust collection efficiency CONSIDER THESE FACTS!"

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

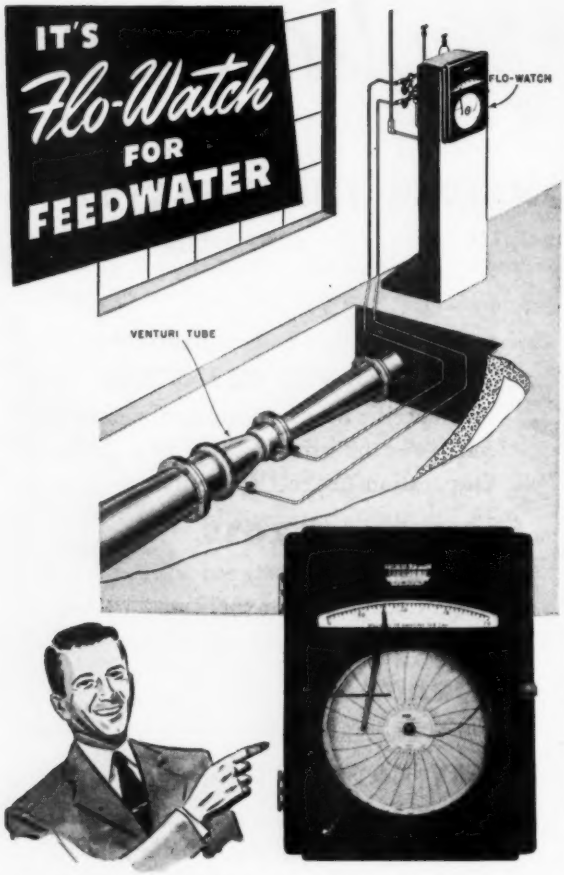
OTHER APPLICATIONS

Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois



Builders Flo-Watch gives you the complete story on boiler feedwater in a single, space-saving instrument. You get recording, totalizing, indicating of flow — or any combination — in this attractive 14⅝" by 20¼" instrument. Flo-Watch is mechanically actuated . . . responds accurately (within 1%) to the flow through Venturi Tube, Nozzle, or Orifice Plate. The seven-digit, cyclometer type totalizer, the large 10" indicator with evenly spaced graduations, and the uniformly graduated 12" chart tell the facts at a glance. Flo-Watch can be installed anywhere within the plant . . . can also be employed to pace chemical feeders and other secondary equipment. For Bulletins and complete information, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 357 Harris Ave., Providence, Rhode Island.

BUILDERS makes a complete line of flow meters and controllers for liquids, steam, air, gas, and dry materials . . . mechanical and differential . . . including The Venturi Meter and Chlorinizers (chlorine gas feeders).

BUILDERS PROVIDENCE *Instruments*

"SPOT" NEWS OF INDUSTRY

(Continued from page 110)

the engineering profession is particularly interested cover the entire process of extracting the maximum proportion of energy from the fuel. Everything in the way of equipment from the bunker or coal pile to load distribution enters into the calculations of the engineers, which completely encompass the field of the Power Show.

Apparatus particularly appropriate to the problem of smoke suppression includes oil and coal handling equipment, piping, pumps and burners, grates, fire walls and insulating materials, stokers, draft equipment, fire and draft controls. Smoke indicating instruments, of which there will be several displays at the Palace, are recommended equipment for all stationary boiler plants. Fireman or operator then can know at all times the shade or appearance of any smoke emission from the stack.

One group of exhibits will consist of dust separating equipment. These are recommended for all new installations of pulverized coal burning equipment, spreader stokers or similar suspension burning types. Dust separators may be of several types, such as settling chambers, baffle collectors, electrostatic collectors and several types of centrifugal collectors.

Centrifugal collectors depend for their action on the inertia of the suspended dust particles. A new type of equipment, the principle of which is in high repute in Europe where it originated, will be seen for the first time at the exposition. This equipment utilizes the inertia of the dust particles in conjunction with the aerodynamic forces in the draft to produce a highly efficient separation through a series of very fine louvres in a cone-shaped filter element.

To insure
SUPERIOR DESIGN
NO MAINTENANCE COSTS
Write for

FLEXIBLE HOSE FACTS

● **Our engineers do not use crystal balls to solve flexible metal hose design problems. And ATLANTIC METAL HOSE catalogs on Flexible Hose Facts are not equipped with electronic "homing" devices to find you.**

But they offer 37 years' authoritative experience and data on problems involving vibration dampening, connecting misaligned structures, mobile services . . . conveying oil, gases, chemicals, steam, compressed air, light or semi-solids under pressure and temperature extemes.

Flexible metal hose in all workable metals from 1/8"-36" I. D. inclusive. Standard or special couplings.

Write today for Catalog 100.

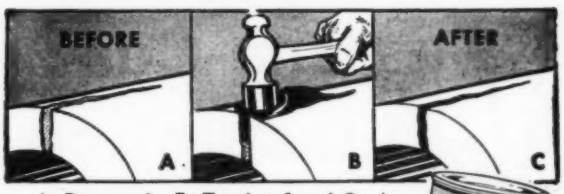
See our Catalog in Sweet's File for Product Designers.

ATLANTIC
METAL HOSE CO., INC.
124 West 64th St., New York 23, N. Y.

New Mill Produces 9 in. Seamless and Welded Tubing

Specialty steel tubing, both seamless and welded, ranging in sizes from ½ to 9 in. OD can now be produced at the revamped and modernized Gary Works of National Tube Co., a United States steel subsidiary. Most unusual of the new equipment is the No. 3 seamless mill, a push-button installation that can shunt pierced shells from the mill in any one of three separate directions, depending on the type of tubing to be rolled.

This mill, an entirely new development, features continuous rolling on a mandrel and incorporates the stretch-reducing process in twelve separately powered stands. Stretch-reduction is accomplished by speeding up each suc-



A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

If You've Never Used SMOOTH-ON, *read this:*

Smooth-On No. 1 Iron Cement is a metallic powder which you can mix with water to the consistency of putty. You tamp it, while still soft, into a crack or hole, making sure to force it against all surfaces. With Smooth-On you don't need to use heat or special gadgets. As it hardens, it expands slightly, clinging tightly in place. The repaired part is ready for use as soon as Smooth-On sets hard. Keep Smooth-On handy for both emergency and routine maintenance repairs. Buy it in 7 oz., 1 lb., 5 lb., 20 lb., or 100 lb. If your supply house hasn't Smooth-On No. 1, write us.

FREE 40-PAGE REPAIR HANDBOOK

Shows many industrial and home repairs made with No. 1 and other Smooth-On Cements. Leaks stopped, cracks sealed, loose parts made tight. 170 illustrations. Drop us a line for YOUR free copy.

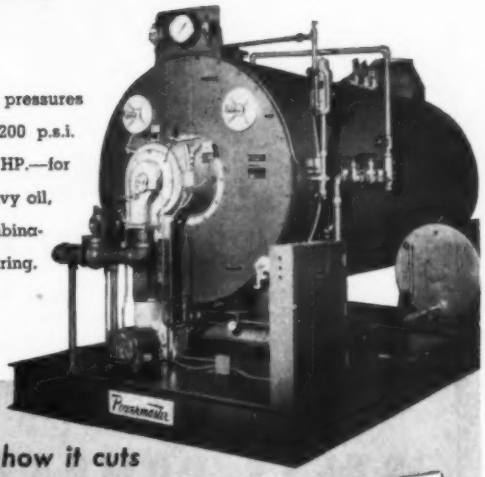
SMOOTH-ON MFG. CO., Dept. 19
570 Communipaw Ave., Jersey City 4, N. J.

50-293

Do it with **SMOOTH-ON**
THE IRON CEMENT OF 1000 USES

15 HP. to 500 HP. -any size Powermaster gives you low-cost steam!

Available in pressures from 15 to 200 p.s.i. —15 to 500 HP.—for light oil, heavy oil, gas and combination gas-oil firing.



Here's how it cuts your operating costs:

- ✓ Low fuel consumption through high efficiency
- ✓ Low-cost installation due to packaged design
- ✓ Reduced man-hours through automatic operation
- ✓ Mounted on steel base; no bricking required
- ✓ Delivered fully wired and factory-tested
- ✓ A.S.M.E. constructed; Underwriters' approved
- ✓ Prompt service by factory-trained men

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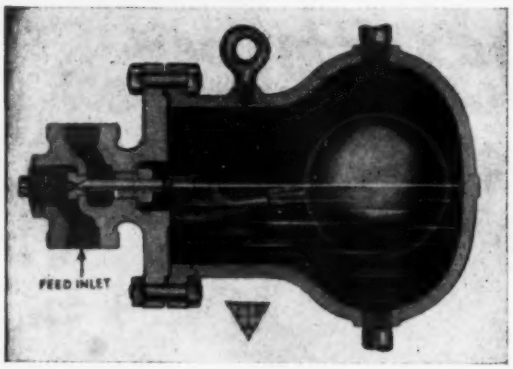
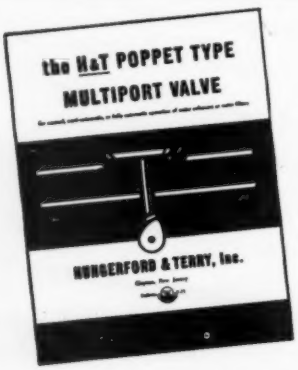


you get *plus-value* with Stets Type G regulators

Valve-in-end construction gives you simple, compact design that's built for maximum performance. You can get Stets Type G regulators in either piston or orifice valve units—250-400 w. s. p.—other types to 900#. Write today for bulletin 150 with full facts on the Stets new Low Pressure Type G Regulator.

STETS COMPANY

1440 BROADWAY — NEW YORK 18, N. Y.



NEW
Bulletin V-11

Order your copy today!

The H & T Poppet Type Multiport Valve for

Manual, Semi-Automatic or Fully Automatic Zeolite Water Softeners or Pressure Filters.

A masterpiece of workmanship and operating simplicity.

When you buy new water softening or filtration equipment, or modernize your existing equipment, make sure you use the H & T poppet valve.

Copy of Bulletin V-11 sent on request — or a nearby representative will call on request.

HUNGERFORD & TERRY, INC.
Clayton, New Jersey

Over 50 years experience—Over 5,000 installations

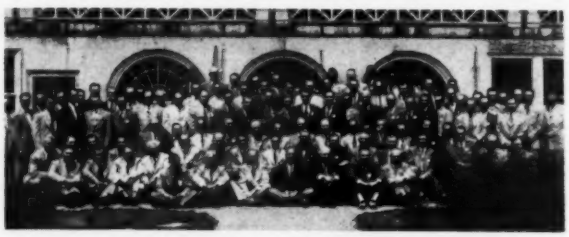
cessive roll stand; the added speed from one stand to the next stretches the tube.

Tension acts along the tube length and reduces wall thickness. This method is especially suited to the manufacture of small diameter tubing in long lengths. Delivery speeds run from 850 to 1,700 fpm.

A 160-ft cooling table of the rotating screw roller type oscillates the stretched and reduced tubes back and forth across the rollers approximately 6 ft. It is designed to insure delivery of straight tubes to the cold saw.

Industrial Water Treatment Course To Be Repeated by E. F. Drew & Co. Inc.

"Water Course" which has been so favorably received by plant managers, superintendents, engineers, and chemists in



FISHER GOVERNOR CO. HOLDS SALES MEETING

Fisher Governor Co. recently held a three-day international sales meeting at its home office and factory in Marshalltown, Iowa. Representatives, sales engineers and their wives from the Fisher offices throughout the United States, Canada and Mexico were in attendance as guests of the company

New One-Coat Insulation Finish

Super Finish Stic-tite applied over regular Stic-tite on high pressure lines.

Now you can trowel to a smooth hard finish *without cracks* in one coat.

R & I Super Finish Stic-tite has practically no shrinkage and, in this way, eliminates cracking so common in ordinary finishes.

It is very easy to use because it is so adhesive.

It's ideal for troweling directly over blankets, blocks and other insulating cements.

R & I Super Finish Stic-tite is smooth, hard, strong, water resistant and serviceable at temperatures up to 1700° F. It finishes white.

Write us for Bulletin I-85

REFRACTORY & INSULATION CORP.
119 Wall St., New York 5, N. Y.
Chicago 4, Ill., Cleveland 15, O., Newark 2, N. J., Philadelphia 2, Pa.

Super Finish Stic-tite

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 25 cents.

We also have a few copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Boiler Houses Are Necessary Evils", February, 1950.
"Caribou Diesel Plant Built in a Hurry", February, 1950.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . . " October, 1949.
"Diesels In A Hydroelectric System"—June, 1950.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
"Grievances Can Be Avoided", April, 1950.
"How To Select Correct Steam Trap", Thomas Trail, January, 1950.
"How To Select Corrugated Expansion Joints", June, 1950.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Low Cost Auxiliary Power From Turbine Drives", April, 1950.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Cattell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

ERNST WATER COLUMNS
& LIQUID LEVEL GAGES

For Every Application

Split-Gland Water Gages
Mica Shields and Gaskets
Gage Glass Illuminators
Sight Flow Indicators
Safety Plastic Guards
Sight Glass and Discs
Flat Glass Inserts
Tubular Glasses
Try Cocks, Etc.

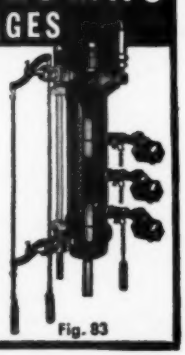


Fig. 83

WRITE FOR BULLETIN

Ernst Water Column & Gage Co.
LIVINGSTON, N. J.

Egbert had only one tube cleaner!

When boilers wore bustles, Egbert — the maintenance man — was a busy fellow. Tubes never seemed to "come clean" no matter how hard he tried. Scale builds up more slowly in modern boilers. But it can be a bigger, more costly headache. That's why thousands of modern boiler plants around the world use powerful, fast-acting Wilson Tube Cleaners.

Egbert's eyes would shine if he could see how quickly and thoroughly Wilson Tube Cleaners remove scale and other deposits from boiler tubes. There is an easy-to-handle Wilson Tube Cleaner for every kind of scale — hard or soft, thick or thin, variable in depth. A large variety of cutter heads and accessories make it simple to clean straight or curved tubes. Wilson Tube Cleaners — driven by air, steam, water or electricity — do a "custom" job, save down-time, are more economical.

For fast, easy rolling . . .
WILSON-DUDGEON TUBE EXPANDERS

Use them to re-roll old tubes or install new ones. Precision manufactured Wilson-Dudgeon Tube Expanders insure solid seating, easy rolling. All sizes, in flaring and non-flaring types, available.

WRITE FOR BULLETIN 47-A
on Tube Cleaners and Bulletin 380 on Tube Expanders.

THOMAS C. WILSON, INC., 21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

TW 777

WILSON

WILSON TUBE CLEANERS
WILSON-DUDGEON TUBE EXPANDERS

For a better drive, select the proper Cleveland unit

WRITE for copies of the latest Cleveland catalogs for full information on all types and sizes of worm gear speed reducers —including rating tables, dimensional diagrams and data for both standard and fan-cooled units. Ask for Catalog 200 for standard drives and Catalog 300 for Speed-aire (fan-cooled). The Cleveland Worm & Gear Co., 3253 East 80th St., Cleveland 4, O.

CLEVELAND
Worm Gear
Speed Reducers

TAMP
←
TRUCK OVER
→
NO WAIT FOR DRYING

HERE'S THE QUICKEST, BEST WAY TO
PATCH BROKEN FLOORS

New plastic repair material is ready for traffic almost the moment it's put down. Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is restored to solid smoothness . . . back in service with ut delay. Tough INSTANT-USE bonds tight to old concrete, makes long-lasting heavy duty patch or complete overlay. NOTE: Plasticizer makes INSTANT-USE easy to scoop out of container . . . easy to level, to tamp, to use!

MAIL COUPON for FREE TRIAL OFFER and HAND BOOK OF BUILDING MAINTENANCE

INSTANT-USE

FLEXROCK COMPANY (Offices in principal cities) 3605 Filbert St., Philadelphia 4, Pa.

Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN and HAND BOOK OF BUILDING MAINTENANCE—no obligation. (Clip and attach Coupon to Co. letterhead).

Name .....
Company .....
Address .....

New York, Cleveland, Detroit, Chicago, Cincinnati and other industrial centers, will be given in Los Angeles on Oct. 17 and 24, and in San Francisco on Oct. 19 and 26.

This course consists of a series of lecture and discussion meetings covering the fundamentals of water chemistry; industrial water problems; plant problems such as steam and condensate lines, heat transfer equipment, service water lines, air conditioning equipment, evaporators and the interpretation of water tests. The sound motion picture, "A Study of Water" will be shown.

The course is conducted by Dr. R. C. Ulmer, technical director, Power Chemicals Div., E. F. Drew & Co., Inc. He will be assisted by members of his technical staff.

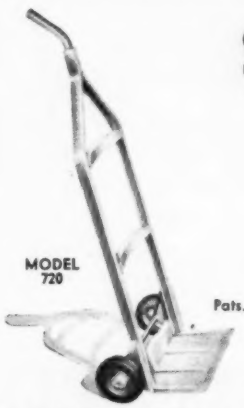
Variable Pitch Sheaves Offer Exact Summer and Winter Air Control

Use of variable pitch sheaves on fans and electric motor shafts for combination direct-fired warm air heating, air conditioning or ventilating systems has proved effective for producing desired year around comfort in commercial establishments and industrial plants. Engineers of Dravo Corporation's heating department report that installations have resulted in considerable savings because of low initial equipment cost and double-duty performance.

Principle involved is varying air volumes for seasonal requirements. Usually, the blower and motor are located outside of the heater casing because of the extra-large sized fan. However, this method can be adapted in standard Dravo Counterflo direct-fired heaters under certain conditions.

Such systems, according to Dravo engineers, are highly flexible in their functions. The variable pitch sheaves can be installed for automatic as well as manual control thereby making the systems virtually 100 per cent automatic.

ITS ANGLE NOSE IS STRONGER



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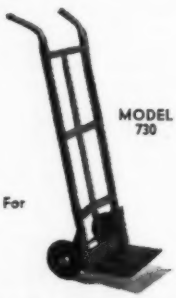


The angle-form, ribbed nose of the "HALLOWELL" ***UNI-TRUK*** is made of heavy pressed steel. ***Triple-welded*** to frame, it gives extra strength at points of greatest stress.

The light weight ***UNI-TRUK*** handles all but the heaviest hand truck jobs, gets ***more*** work done ***faster.***

One and two-handle models. Stair-climbers available.

Send for Form 757-1

"TRY ONE AND YOU WILL BUY MORE"!

See us at Booth 2434, Convention of National Metal Congress and Exposition, Chicago, Oct. 23 to 27.

HALLOWELL
MATERIALS HANDLING EQUIPMENT
SPS STANDARD PRESSED STEEL CO.
JENKINTOWN 39, PENNSYLVANIA

New *VERSENE** test kit determines total water hardness in less than *TWO MINUTES*

Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

Order The New Versene* Water Hardness Testing Kit today. $3.00 Postpaid. Send Checks or M.O. No C.O.D.'s. Money Back Guarantee.

We also manufacture and supply Inhibited Indicator and Di Sodium Versenate (the di sodium salt of ethylene diamine tetra-acetic acid). These are the reagents used in the Versenate (Schwartzenbach) Method for the determination of Water Hardness.

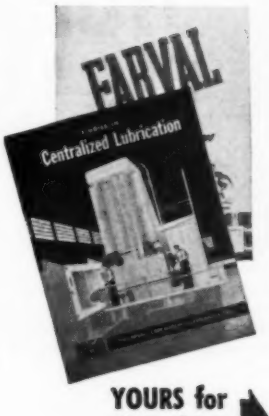
Di Sodium Versenate
50 g. $2.00 100 g. $3.00 500 g. $10.00

Inhibited Indicator
100 cc $1.00 250 cc $2.00 500 cc $3.00 1000 cc $5.00

BERSWORTH CHEMICAL COMPANY
FRAMINGHAM, MASSACHUSETTS

*Trade Mark

New report on savings with centralized lubrication

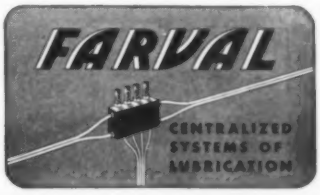


FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies—1950" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

YOURS for the asking



What would it cost YOU to deal with 1900 suppliers?

When you figure bookkeeping, purchasing, freight and other overhead costs in dealing with 1900 different sources of supply it can become a pretty expensive way to buy.

Over 1900 firms supply the more than 33,000 products which Hajoca stocks for industry. By buying from one source—Hajoca—you eliminate the high cost of dealing with many sources of supply for the industrial products you use—AND you have the advantages of a *double* guarantee—the Manufacturer's and Hajoca's.

HAJOCA CORPORATION

GENERAL OFFICES: 31ST AND WALNUT STREET BRIDGE
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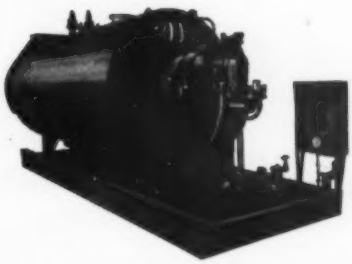
32 BRANCHES SERVING THE ATLANTIC SEABOARD
See your Classified Telephone Directory for local branch address

Hajoca stocks 33,000 products for industry



"PACKAGED" STEAM BOILERS

Completely Equipped and tested at factory.

Fully Automatic. Heavy Oil, No. 6.

60 to 500 Horsepower plus ample overload.

Efficiency and Capacity proved in every day practical service and fully guaranteed.

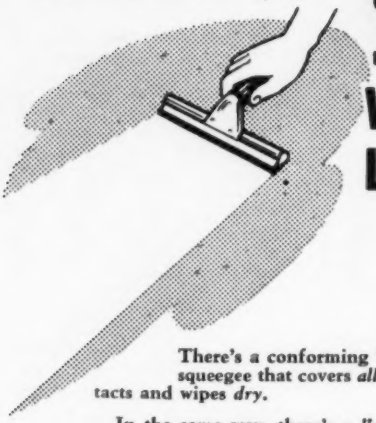
JOHNSTON BROTHERS, INC.

JOHNSTON BROTHERS, INC.
Ferrysburg, Michigan

Please mail catalog with full information.

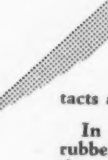
NAME .....
COMPANY .....
ADDRESS .....

"SQUEEGEE ACTION" STOPS VALVE LEAKS . . .



There's a conforming "give" in a rubber squeegee that covers *all* the surface it contacts and wipes *dry*.

In the same way, there's a "give" in the tough rubber face of DeZURIK valve-plugs that gives them "squeegee action" on the valve seat . . . produces a skin-tight, bone-dry closure. The plug-face conforms and seals even if the valve-seat is worn or if it harbors scale or foreign matter.



A trial installation of DeZURIK Easy-Operating Plug Valves will prove that *valve leakage can be stopped!* Write for catalog.

DEZURIK SHOWER CO.
SARTELL, MINNESOTA

Who Knows — And What

Selected readers have received, or shortly will receive, from The A. N. Marquis Co. requests for information pertaining to their personal specialities within their occupational fields. Information submitted will be reviewed to determine suitability for inclusion in "Who Knows—And What", the second edition of which is now being compiled.

The unique reference value of this book stems from:

1. Inclusion of only those persons having special skills or knowledge in one or more of thousands of highly-specific topics judged by the editors to be subject of general reference interest, together with information on research and experience in these fields; general public or professional eminence is not a deciding factor in selections.

2. A locator index, which refers the user by means of a simple key to the listing of any person in the book having special knowledge about any one of the subjects included in the index.

The company, which also publishes "Who's Who in America" will welcome any suggestions from readers. Communicate directly with the company at 210 E. Ohio St., Chicago 11, Ill.

Paper and Tape Are Now Reinforced With Fiberglas

Paper reinforced with Fiberglas yarns has just been announced by the Owens-Corning Fiberglas Corp. Comparison tests have proved the superior service advantages of this type reinforced paper and tape. Among the specific property advantages are great strength, light weight, dimensional stability, resistance to breakdown from heat or cold, non-absorption of moisture and rot-resistance.

with a LIQUIDOMETER Tank Gauge

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

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ELECTRIC, GASOLINE, DIESEL

Let *Silent Hoist* Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.

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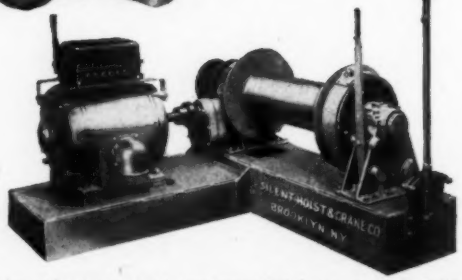
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



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SILENT HOIST & CRANE CO.
856 63rd STREET, BROOKLYN 20, N. Y.

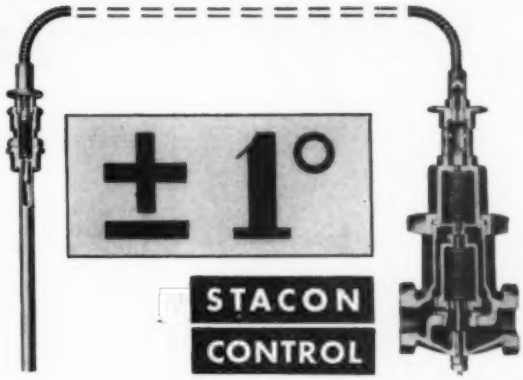
Colored Sound Film Shows Railroad Smoke Abatement Progress

"I Was Inquisitive" is a colored sound film that shows approved practices for smokeless operation of locomotives. The film, prepared under the auspices of the Railroad Sub-Committee of the Coal Producers Committee for smoke abatement, was made in Columbus as part of the Model City Smoke Abatement program. All railroads operating in the city participated in making the film. These carriers are the Baltimore & Ohio RR, Chesapeake & Ohio Railway Co., Norfolk & Western RR, Pennsylvania RR and New York Central System.

How fires should be built in cold engines; maintaining and cleaning fires; firing an engine in yard service, in road service; and how to build an engine fuel bed with a stoker are covered.

Scenes in Columbus roundhouses indicate what has been accomplished by following the methods depicted. The film gives visual evidence that railroad smoke, even in a railroad center as large as Columbus, can be held to the minimum. The film will be viewed in roundhouses and railroad yards throughout the country.

Members of the Railroad Sub-Committee are: A. A. Raymond, superintendent of Fuel and Locomotive Performance, New York Central System; Walter L. Lloyd, assistant engineer, Pennsylvania RR; W. H. Powell, supervisor of Locomotive Operations, Baltimore and Ohio RR; D. J. Coon, mechanical and test engineer, Nickel Plate Road; and J. S. Swan, fuel conservation engineer, Louisville and Nashville RR. Mr. Raymond and E. D. Benton, director of research, Fuel Engineering Div. of the Ohio Coal Association were in charge of the production. Actual work on the film was done by the advertising department of the New York Central System.



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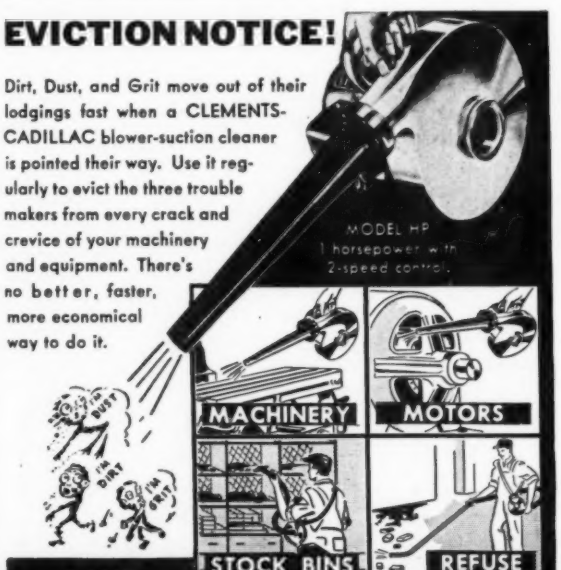

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whatever your elevator problem, the answer is

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Reading, Pennsylvania

NEW

IDEAL FLEXIBLE ABRASIVE

- Cleans Commutators
- Gives Burnished Finish to Commutators After Grinding

The perfect tool for use following grinding or using a regular Resurfacer on the commutator. Made of a fine grain abrasive material held together by a flexible bond. It's gentle, fast action quickly removes surface imperfections with minimum cutting . . . Used as a commutator cleaner it quickly removes high resistance film, dirt and grease. Cleans like an eraser and generates very little dust—wears down slowly without "gumming" or dusting. Does not affect the face of the brush or cause filling of commutator slots. Non-conductive and non-loading — can be safely used with motors or generators operating. *Will not scratch or score commutators or rings . . .* Very easy to use. Just hold it against the face of the turning commutator or slip ring. FIVE SIZES — Order by Catalog number.

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82-002	⅜ x ¾ x 5
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Insulation
Lubrication
Maintenance
Material Handling
Packings & Gaskets
Pipe and Fittings
Plant Equipment
Power Transmission
Pumps
Refractories
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Steam Turbines and Engines
Tools and Small Specialties
Traps, Strainers and Separators
Valves
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Welding Equipment
Wire Rope
Miscellaneous

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If slime and algae cause trouble in your cooling towers, it will pay you to read Monsanto Technical Bulletin No. O-15. For your copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk A, 1743 South Second Street, St. Louis 4, Missouri.

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SERVING INDUSTRY...WHICH SERVES MANKIND

IF AIR-MOVEMENT CAN DO THE JOB...

Hartzell can move the air!

1,250,000

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Hartzell ventilation systems are efficiently handling factory ventilation problems everywhere. Operating costs are low, and Hartzell systems remain trouble-free year after year. Ventilation, to Hartzell, includes dissipation of heat, fume and dust concentrations, as well as duct and ductless air-change systems. But Hartzell does many things, where air is concerned, in addition to ventilation. If you need air-movement for any purpose, get Hartzell engineering on the job.

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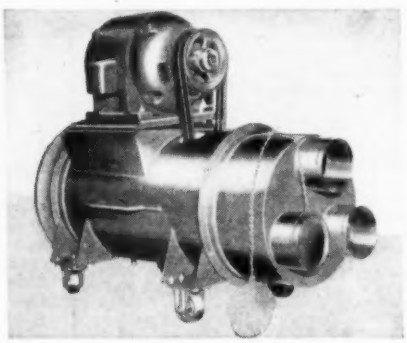

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